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STANDARDIZING MAGNETIC TESTS.

Upon another page of this issue will be found the text of the standard tests which have been proposed for adoption by the American Society for Testing Materials. Conditions of magnetic testing have long been unsatisfactory on account of the lack of such a standard, since the results of magnetic tests, perhaps more than any other, are susceptible to slight differences in the conditions under which tests are made, and the results by different methods are scarcely comparable. The American Society for Testing Materials is to be congratulated upon taking a step forward in this matter so long neglected, and great credit is due to its committee on magnetic testing for at last having presented a report containing definite recommendations upon this subject. While it is not to be assumed that this report is the last word upon the subject, or that these tests, if adopted, will remain unaltered indefinitely, it will be advantageous to have definite methods of test recognized as standard, providing common ground upon which purchaser and manufacturer can meet in deciding upon the acceptability of material. The great advantage of such standardization lies in its use by those persons who are not sufficiently acquainted with the subject to draw up for themselves specifications which shall be adequate for the purpose.

The proposal of the committee, which is to be submitted to a letter ballot of the Society, covers tests of two kinds, those for determining core loss and those for determining curves of magnetization or permeability. Tests of the latter kind are the most difficult of execution, at least when a complete magnetic circuit of the material to be tested is not available. The scheme proposed is one which has been elaborated by Dr. Charles W. Burrows, the chairman of the committee, in his work at the Bureau of Standards. It probably represents the best procedure, from the standpoint of accuracy, that is now available for straight strips and rods.

The test proposed for core loss is substantially that of Epstein, which has come into general use in Germany and has been used quite extensively in this country. A few modifications have been made in details, such as the adoption of sixty cycles as the standard frequency for tests and the use of secondary windings on the specimen for use in the measurement of voltage and power. While the latter refinement adds to the ease and accuracy

of measurement, the propriety of making it mandatory may seem questionable, since the errors introduced by connecting the instruments to the primary winding, may, with a low-resistance primary, be less than the uncertainties due to other factors.

One of the most potent sources of error in wattmeter tests for core loss is the lack of knowledge of the wave form. The present specifications provide for a sine wave, but offer no means for determining how close to a sine the wave may be, nor are any limits of tolerance set. If the definition of a sine wave given by the American Institute of Electrical Engineers in its Standardization Rules be followed, great latitude will be introduced, and a variation made possible in the core loss which should not be permitted. These rules permit a maximum deviation in any ordinate of ten per cent of the maximum ordinate. It would seem much preferable to state the limits of form-factor which are admissible, since the shape of the wave influences the result only in so far as it affects the form-factor. It is quite possible to have a correct form-factor with a wave which is far from having the sine shape.

The specifications appear to assume that the mass of material used will be exactly ten kilograms, or so close to it that the difference may be neglected. In material of the more customary gauges it is true that this assumption, with the number of strips so chosen as to come as close as possible, could not make an error in mass as great as one per cent, but since the core loss varies more rapidly than the mass, the error in watts might easily be more than one per cent. Moreover, if thicker material were being tested, the error due to inexact mass might be much greater. It would seem preferable, consequently, to compute the correct voltage for each test from the actual mass, instead of specifying the voltage in the instructions.

There seems to have been some objection in the minds of the committee members to mentioning silicon-steel in the specifications. The density of the material enters into the formula for computing the voltage, and provision has been made for two kinds of material distinguished by low and high resistance. The latter is evidently intended to cover silicon-steel, since the specific gravity given, 7.5, is an average value for this kind of material. Since no one can tell what the future may bring forth, and a half year may see some other alloy steel, say an aluminum alloy having high resistance but a density different from silicon-steel, coming into use, it would seem much preferable to call a spade a spade, and provide for variations of density in more direct terms.

The committee has included in its specifications a definite aging test, which is greatly to be desired. This is one matter in which an arbitrary standard is decidedly necessary since it is impossible to demonstrate that any one particular set of conditions is the most suitable. A test of 600 hours at a temperature of 100 degrees centigrade is stipulated and this should be acceptable to all those concerned.

The nomenclature used by the committee may be open to some question as to its desirability. The terms "induction" and "magnetizing force" are almost hoary with age and have been extensively used, but very valid objections have been raised against them, and since preferable terms exist, it would be well to adopt them in a document of this kind. The word "induction" is used for a great variety of purposes, and it is desirable in technical usage to restrict each word to a single meaning, especially when it is used quantitatively. This has been done with such words as power, work and force, and it is inadmissible to use these in a quantitative sense in technical documents to mean any but one particular idea. The term flux-density seems preferable to induction on every score, and is, moreover, extensively used. "Magnetizing force" is not a force at all, and moreover is too similar to magnetomotive force, from which it differs, however, in meaning. The quantity meant is the intensity or strength of magnetic field and if a shorter term is necessary, "magnetizing field" is preferable to "magnetizing force." Furthermore, since there is a lack of unanimity as to the propriety of measuring this quantity in terms of the same unit as flux-density, it would be well to reserve the gauss for the latter and express magnetizing fields in terms of ampere-turns per centimeter or of gilberts per centimeter, the latter being consistent with the other units used.

ELECTRIC-FURNACE ECONOMY.

Although the field of electrometallurgy is one of the most highly specialized in modern industry, certain aspects of work with the electric furnace deserve the consideration of engineers whose practice lies along the lines of power transmission and distribution from central stations. Probably the majority of electrical engineers will never be called upon to design an electric furnace, but as such devices offer loads to companies selling power in large blocks, it is desirable to appreciate the directions in which economical operation is proceeding in connecton with important electrochemical heating processes.

Low cost of power is an absolute necessity to the commercial success of most electrochemical processes. The Niagara region has gained much of its electrical pre-eminence on this account, while in Norway, the almost nominal cost of power—sometimes reported as low as $5 per horsepower per year—has been a factor of fundamental importance in such work as the fixation of atmospheric nitrogen for agricultural purposes. The possibilities of such prices as $5 or $10 per horsepower-year in this country do not seem very bright at present, but if the figures quoted in the Scandinavian peninsula cannot as yet be reached here, it is at least possible for power companies and central stations to bill current at prices in some degree commensurate with the value of continuous loads

lasting for long periods to the investor in electrical generating and distributing equipment.

Beyond this, it is well for the central-station operator to know that the cost of electrometallurgical work is rapidly decreasing in many installations through the more scientific study of such matters as the design of furnace terminals, the improvement of contacts, use of spiral air blasts in contracted tubes carrying arcs, adoption of control of arcs by external magnetic fields, and by the closer examination of materials available for furnace terminals, fluxes, and supports of moving parts. It is surprising how much has been gained through the investigation of the possibilities of air blowers, the use of water for cooling terminals, the analysis of costs on the basis of different voltage and current values, the more accurate measurement and tabulation of temperatures, pre-heating of gases, use of refractory metals as electrodes to ionize the arc flame, varying the pressure within chambers where electrochemical processes take place, and finally, by the use of devices permitting a large part of the energy expended in the furnace to be recovered and utilized either in connection with the preliminary processes or in relation to the production or treatment of by-products.

The opportunities for improving electric-furnace economies are of course in part chemical in character, but the foregoing points show how important are the physical problems of the apparatus. The longer one observes the applications of electricity in varied industrial fields, the more is one impressed with the extent to which a few fundamental principles and phenomena control affairs. It is not too much to expect that experience in the use of electricity in one field may result in the application of methods of great value in another domain fulfilling an entirely different function in the activities of the human race. The central-station man may see an opportunity to recommend the installation of a water-cooled stuffing box or the use of a new type of electrode which may result in vast improvement in a field whose detailed workings are entirely outside his experience. Labor-saving machinery cuts costs everywhere, provided work is done on a large scale, and every step forward in such a specialized art is inevitably an advance in extending the value of electric service.

A MUNICIPAL BAKING OVEN.

A unique evidence of municipal business-getting is noted in the case of a California city which purchases power from an outside company retailing it to local consumers. This city plans to purchase a large electric baking oven with the intention of renting it to local bakers at a price allowing a moderate profit. While such an idea might be applicable in only a few cases it is a suggestion for central stations which are taking steps toward securing a permanent heating load. Familiarity with the advantages of using electric power frequently results in the purchase by a consumer of his own current-consuming apparatus.

THE USE OF ALUMINUM.

When aluminum first became commercially available it was heralded as a possible substitute for copper in electrical conductors. While the specific conductivity of aluminum is less than that of copper when compared on the basis of volume, its extremely low specific gravity renders the weight of a conductor of definite resistance only about one-half of that of copper. Consequently as soon as the price per unit of weight became less than twice as much for aluminum as for copper, it immediately became a competitor for all work in which the main question involved was the amount of metal necessary in the conductor. The first electrical applications of aluminum were consequently for busbars, bare overhead conductors, and similar uses. In cases where the temperature rise, rather than the drop in potential, was the determining factor in choosing the size of conductor, it was found unnecessary to make the weight of conductor even one-half as great for aluminum as for copper, since the increased radiating surface prevented an equal rise in temperature for equal linear conductivity.

In cases where insulated conductors were used, however, it was found that the increased costs of insulation neutralized the saving which might be effected by the use of aluminum as a conductor, and consequently its use for this purpose has received very little encouragement up to the present time.

There is one other consideration, however, which has recently led to its adoption in apparatus requiring the use of insulated conductors. This is a question of weight, considered not alone from the point of view of the amount of material required in the conductor, but from the consideration of the work which must be done in moving the apparatus itself. In all cases where weight of the apparatus is a factor of importance in the design of machinery, it would seem desirable to consider the use of aluminum conductor in place of copper. This applies principally to apparatus of movable nature, such as that connected with rolling stock in the case of electric traction.

This matter has received more consideration in Europe than in this country and aluminum coils have been displacing copper in the fields of railway motors. It is found that a saving of weight in the coils of from forty to sixty-five per cent can be realized. This not only reduces the load on the motors, but has an effect upon the wear of the track. The item of weight in these cases is considered of greater importance than the cost.

Another instance where this metal has been used in Europe with gratifying results is in the coils of lifting magnets. In this case any saving in the weight of the magnet itself will render the necessary capacity of the lifting motor so much less. The saving consequently resides not only in the amount of useless expenditure of energy in lifting the dead weight of the magnet, but also in the capital necessary for investment in the installation.

Memorial to Alexander Henderson.

The Henderson memorial will be dedicated on Sunday, July 16, at Southampton, Long Island. The train will leave the Pennsylvania station (Long Island Section), at 10:32 a. m., arriving at Southampton 12:58 p. m., returning 4:12 p. m., arriving in New York 6:51 p. m. This schedule will give sufficient time to obtain dinner at the hotel at Southampton, proceed with the dedication exercises, and return to New York on the train mentioned.

Alexander Henderson was born in 1859, and died a little over a year ago. He was one of the most popular men in the electrical fraternity, and numbered among his best friends many of those engaged in the electrical contracting industry. It is expected that many of the contractors and manufacturers' representatives attending the convention of the National Electrical Contractors' Association at Niagara Falls next week will stop in New York over Sunday so as to take part in the dedication ceremonies.

Commencement of the Clarkson School.

The twelfth annual commencement of the Clarkson Memorial School of Technology, at Potsdam, N. Y., was held during the week beginning June 11. At the baccalaureate services on Sunday an address was made by Bassett Jones, Jr., of New York City, on "Life Efficiency."

On Wednesday afternoon the cornerstone of the new gymnasium building was laid. At the commencement exercises on Thursday morning an address was delivered by G. W. Littlehales, of Washington, D. C., on "The Engineer and the Society of Nations." At the close of the exercises a loving cup was presented to Prof. William S. Aldrich, the director of the school, as testimony to his able management of the college for the past ten years. Director Aldrich is about to sever his connection with the institution. His successor will be John P. Brooks.

The Philadelphia Electrical Contractors' Association.

At the annual meeting of the Philadelphia Electrical Contractors' Association the following officers were elected for the ensuing year: President, Wilson McCandless; vice-president, Stewart A. Jellett; treasurer, M. E. Arnold; secretary, M. G. Sellers; board of directors, Walter C. McIntire, A. E. Bainbridge, Gilbert S. Smith.

Meeting of Cotton Association.

The Board of Government of the National Association of Cotton Manufacturers has decided to hold the ninety-first meeting of that organization at Hotel Equinox, Manchester, Vt., beginning on the evening of September 27 and continuing for the two following days.

The first meeting will be devoted to the President's address by Franklin W. Hobbs, Brookline, Mass., and also an address of welcome by John H. Mead, Governor of Vermont, to be followed by an informal reception.

It is also expected that James Wilson, Secretary of Agriculture, and John Wingate Weeks, member of Congress, and also an honorary member of the Association, will address the meeting at some of its sessions.

Convention of the Illuminating Engineering Society.

The fifth annual convention of the Illuminating Engineering Society will be held in Chicago on September 25, 26 and 27. The Committee on Papers is making arrangements for an interesting technical program. The General Convention Committee, of which John F. Gilchrist, of Chicago, is chairman, has made such considerable progress in the general arrangements that it is safe to say that the convention will be unique in many ways. Particular care will be exercised so that the entertainment features will not be distracting from the general purpose of the convention, but will rather promote this end. For this purpose a number of informal inspection trips in small groups to interesting lighting installations in the city are being planned.

English Delegates to Turin Congress.

The Institution of Electrical Engineers has appointed the following delegates to represent it at the International Electrical Congress in Turin next September: S. Z. de Ferranti, R. E. Crompton, W. Duddell, R. T. Glazebrook, R. K. Gray, R. Hammond, W. A. J. O'Meara, A. Siemens, and S. P. Thompson.

Receiver for Ball & Wood Company.

Judge J. K. Rice has been appointed receiver for the Ball & Wood Company, manufacturers of steam engines. The receivership was asked for by Mr. Greenwood of the company, the appointment being made on Thursday of last week. It is believed to be only temporary.

Electrical Exports for May.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has issued its monthly summary of the imports and exports of the United States for the month of May, 1911. From this the following facts relative to the exports of electrical products are obtained.

The figures for May are lower than those for the preceding month and also those for May of last year. This should cause no alarm, however, for April was this year's record month and May was the record month last year. On the contrary, the figures for last May are well up to those for the earlier months of the present year and therefore indicate no marked retrograde movement, but rather a persistence in the improved conditions established several months ago. The comparative monthly figures are:

Month.	Electrical Appliances.	Electrical Machinery.	Total.
May, 1911	$ 987,264	$627,840	$1,615,104
May, 1910	1,025,549	684,938	1,710,487
April, 1911	1,064,562	888,283	1,952,845

A list of the principal countries to which electrical products were sent last May and the values of these shipments is as follows:

Exported to—	Electrical Appliances.	Electrical Machinery.
United Kingdom	$ 41,196	$ 49,715
Canada	324,731	156,774
Mexico	49,411	70,050
Cuba	85,568	33,291
Brazil	177,361	50,638
Japan	96,585	59,070

Advanced Study in Electrical Engineering at the Massachusetts Institute of Technology.

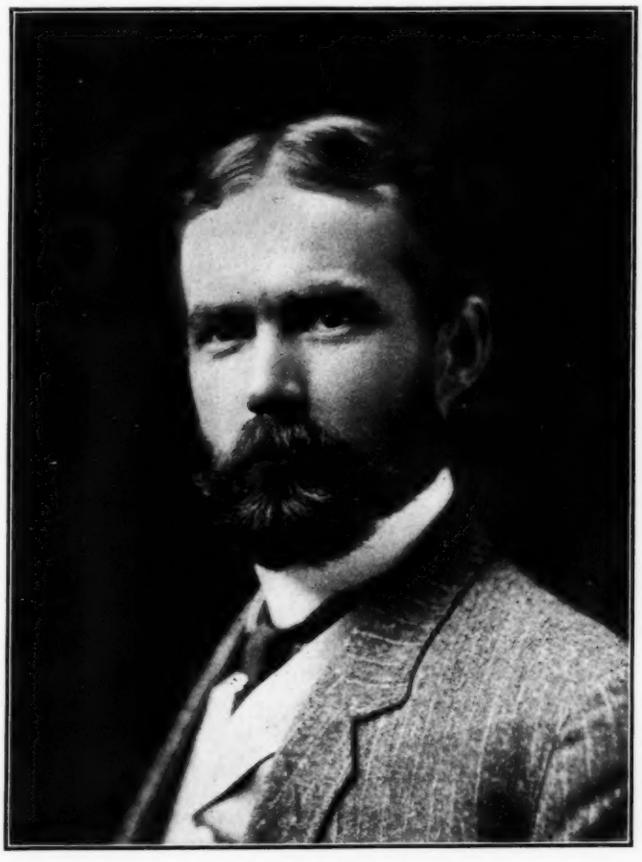
The past year at the Massachusetts Institute of Technology has found an increasing number of graduate students. Professor Jackson's lectures on the Organization and Administration of Public-Service Companies were attended by a class of twelve graduate students and Professor Pender's lectures on Advanced Alternating Currents and the Transmission of Power were attended by an even larger number of graduate students. Professor Wickenden's advanced course in the Design of Central Stations and Distribution Systems has also been in demand.

Besides graduating the largest class from the undergraduate course which the Institute of Technology has heretofore graduated in electrical engineering, one degree of Doctor of Engineering and four degrees of Master of Science were conferred on men taking their major work in electrical engineering.

L. D. Mathes.

A sunny disposition, a cordial way of greeting his fellow-man, the faculty of giving able counsel when this is dearly needed, and a wise and wide knowledge of his business have made L. D. Mathes, general manager of the Union Electric Company, of Dubuque, Iowa, a man beloved by many, respected by all, indeed a valuable member of the electrical fraternity.

Mr. Mathes enjoys the distinction of being a past master of the art of steam and electric railroading, and also general manager of one of the most progressive and enterprising central stations in the country.



L. D. MATHES
General Manager, Union Electric Company, Dubuque, Iowa.

L. D. Mathes is a native of Tennessee, where he was born forty odd years ago. After graduating from the University of Tennessee he entered the shops of the Memphis & Charleston Road at Memphis, Tenn. He left this company shortly afterward to take up electrical work with the Edison General Electric Company, later on joining forces with the Westinghouse Electric & Manufacturing Company, with both of which companies he was engaged in the construction of electric railways and power plants in various sections of the country for about five years. Deciding to familiarize himself with operating details he accepted a position as general foreman of the Buffalo & Niagara Falls Electric Railway. Later he resigned to become superintendent of the Norfolk (Va.) & Ocean View Railway, then in the hands of a receiver. During his two and one-half years' service with this company he developed a considerable freight business and operated the lines with such success that he restored the road to the original owners and placed its finances on a sound and profitable basis. He subsequently became general superintendent of the Charleston (S. C.) & Sea Shore Railway, resigning at the end of a year to accept a similar position with the Norfolk & Atlantic Terminal Company, which in addition to its freight and passenger business, operated a line of steamers.

The railway field did not allow Mr. Mathes sufficient scope for the broader general training he had received in his earlier career, and he became imbued with the idea that in the West lay greater opportunities for his work. He therefore severed his connection with the Norfolk people. Mr. Mathes has been general manager of the Union Electric Company of Dubuque, Iowa, since 1903. While connected with this company he has introduced many innovations and has made Dubuque a thoroughly representative center of electrical endeavor. Mr. Mathes was the first secretary and treasurer of the Iowa Street & Interurban Railway Association, and he served as president of both the Iowa Street & Interurban Railway Association and the Iowa Electrical Association. He is a familiar figure not only at the state conventions but at the conventions of the National Electric Light Association. He has contributed liberally to the discussion at both the state and national conventions and has been a valuable member of a number of important committees. He is also a member of the Illuminating Engineering Society.

Chicago Committee on Electrification.

The Committee of Investigation on Smoke Abatement and Electrification of Railway Terminals, which was organized through the instrumentality of the Chicago Association of Commerce, has appointed two engineers to assist Horace G. Burt, the chief engineer. The new men are Louis H. Evans, terminal engineer, who has already begun work, and Hugh Pattison, electrical engineer, who will join the force on August 1. These appointments will be followed by the selection of other men, as the necessities of the investigation dictate enlarging the staff.

Mr. Evans, who is concerned with a study of existing terminal conditions, has been chief engineer of the Chicago Junction Railway for several years. From 1895 to 1900 he was in charge of the elevation of the track of the Chicago & Northwestern Railway, covering sixteen miles of its right of way at a time when such work in Chicago was in its infancy and presented many unsolved problems. In 1900 Mr. Evans was chosen chief engineer of the Delaware, Lackawanna & Western Railroad and subsequently went into business for himself as a contracting engineer.

Mr. Pattison, whose share in the investigation will concern directly the technical problems of applying electricity as motive power to the many branches of Chicago's great terminal network, was in active charge of the electrification of the Pennsylvania terminal in New York, and is credited with exceptionally broad knowledge of matters pertaining to the electrification of steam railway terminals.

The meetings of the committee will take place monthly, the next meeting being set for Friday, July 28.

Indiana Electric Light Association.

The annual meeting of the Indiana Electric Light Association will be held in South Bend, August 23 and 24, 1911. An excellent program is being prepared and the attendance promises to be good. J. V. Zartman, of Indianapolis, is secretary.

Electric Railway Committee Meets in Indianapolis.

The members of the Committee on Standard Equipment of the American Electric Railway Engineering Association held a two-day meeting at the Claypool Hotel, Indianapolis, Ind., on July 5 and 6, for the purpose of preparing reports on several technical subjects. The committee is composed of the following members: M. V. Ayers, chairman, Boston & Worcester Street Railway Company, South Framington, Mass.; H. A. Benedict, Public Service Railway Company, Newark, N. J.; F. R. Phillips, Pittsburg Railway Company, Pittsburg, Pa.; William Thorn, member of Board of Supervising Engineers, Chicago, Ill.; A. T. Clark, United Railway & Electric Company, Baltimore, Md.; F. G. Grimshaw, West Jersey & Seashore Railroad, Camden, N. J.; J. M. Rosenberg, Illinois Traction System, Champaign, Ill.; Homer McNutt, San Diego Electric Railway Company, San Diego, Cal.; H. L. Patterson, Mahoning & Shenango Railway & Light Company, Youngstown, O.

The committee is divided into subcommittees and these subcommittees considered the following subjects with a view of making reports at the meeting of the Association to be held at Atlantic City in October: Heating and Ventilating Cars; Design of Car Bodies for Light Weight; Design of Car Truck for Light Weight; Standard Couplers and Air-Signal Control Connections.

The question of adopting standard couplers for interurban cars formed the principal topic for discussion, and there was a wide difference of opinion shown to exist among interurban officials as to what constitutes a standard coupler. The Standardization Commiteee of the Central Electric Railway Association was invited to be present and took an active part in the discussion. No definite action was taken leading toward the adoption of any particular coupler. An interesting paper was read on the subject by Milan V. Ayers of Massachusetts, who presided at the meeting. Three reports were prepared to be presented to the Atlantic City meeting in October. The members of the committee took a number of trolley inspection trips and visited the shops at Anderson and Indianapolis. The members of the Central Electric Railway Association Standardization Committee who attended the meeting were: W. H. Evans, Anderson, Ind.; R. M. Hemming, Columbus, O.; L. M. Clark, Indianapolis, Ind.; H. H. Buckman, New Albany, Ind.; and C. E. Morgan, Crawfordsville, Ind.

Cleveland Traction Changes

The City Council has voted to amend the Tayler Franchise under which the Cleveland Railway Company is operating. The amendments made provide for the spending of $2,500,000 for betterments and improvements, the extension of the present three-cent fare limits to include all parts of the former village of Collinwood, the limitation of the period during which the city shall have the right to require extensions to the first ten years of the Tayler grant and provision for the repeal of the amendments provided the Railway Company does not complete betterments within a reasonable time.

The Board of Directors of the Cleveland Railway Company promptly accepted these amendments, but must wait thirty days in order to provide time for the filing of a referendum petition submitting the amended grant to popular vote. President Stanley, of the Railway, has stated that prompt action will be taken if no petitions are filed, and the work of improvement will be begun immediately upon the expiration of thirty days. The Company expects to order and put in service between 50 and 60 new cars and will add to their car equipment as fast as additional power can be provided for their operation until the needed 200 are in service. Several of the lines will be extended, one a link connecting Newburg and Brooklyn.

Wire Men Plead.

A number of the individual defendants named in the indictments recently found by the Federal Grand Jury, at New York City, against alleged pools which constitute the so-called wire trust, appeared before Judge Archbald in the United States Circuit Court, New York, the first of this week, and pleaded not guilty to the charges against them. They were each held in $1,000 bail and were allowed until September 1 to change their pleas or to file demurrers to the action.

Many of the eighty-three indicted officials did not appear, among them Edwin E. Jackson, Jr., of New York, against whom there are nine indictments, and who is said to be in Europe.

Street-Railway Tunnels Under Chicago River.

The engineering feature of the three reconstructed street-railway tunnels under the Chicago River, Chicago, Ill., were pointed out in an address before the Chicago Electric Club on July 5, by William Artingstall, division engineer Board of Supervising Engineers, Chicago Traction.

The rebuilding of these tunnels is co-incident with the remarkable rehabilitation of the Chicago street railways under the "settlement" ordinances of 1907, and also in accordance with the demands of the Federal Government for an unobstructed river channel. The three tunnels affected are the Washington Street, Van Buren Street and La Salle Street tunnels, and all work was carried on under the supervision of the Board of Supervising Engineers.

Mr. Artingstall confined his remarks principally to the La Salle Street tunnel, on which work is still progressing; the other two now being completed and in service.

The river section of the La Salle Street tunnel is a double-bore steel tube which was constructed about one mile from the tunnel site, floated to its location, lined with concrete and sunk in position. Various statistics on this tunnel, together with a description of the method of construction and installation, were given in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for April 8, 1911, page 695.

Supplementing this data Mr. Artingstall said that the concrete walls of the tunnel, forming the land approaches, are among the largest reinforced concrete walls ever constructed, being forty-four feet high, without heels at the base. Over 75,000 cubic yards of material was excavated and 35,000 cubic yards of concrete and 2,000,000 pounds of reinforcing metal used in constructing each wall.

In the former La Salle Street tunnel provision was made to accommodate the various public-utility lines, and as this feature was eliminated in the new design a separate public-utility tunnel had to be constructed. This is ten feet wide, 11.5 feet high and is located about five feet above rock bottom. The river section, of horseshoe shape, is of concrete and connects at either end with vertical brick shafts. Mr. Artingstall exhibited plans of the tunnel.

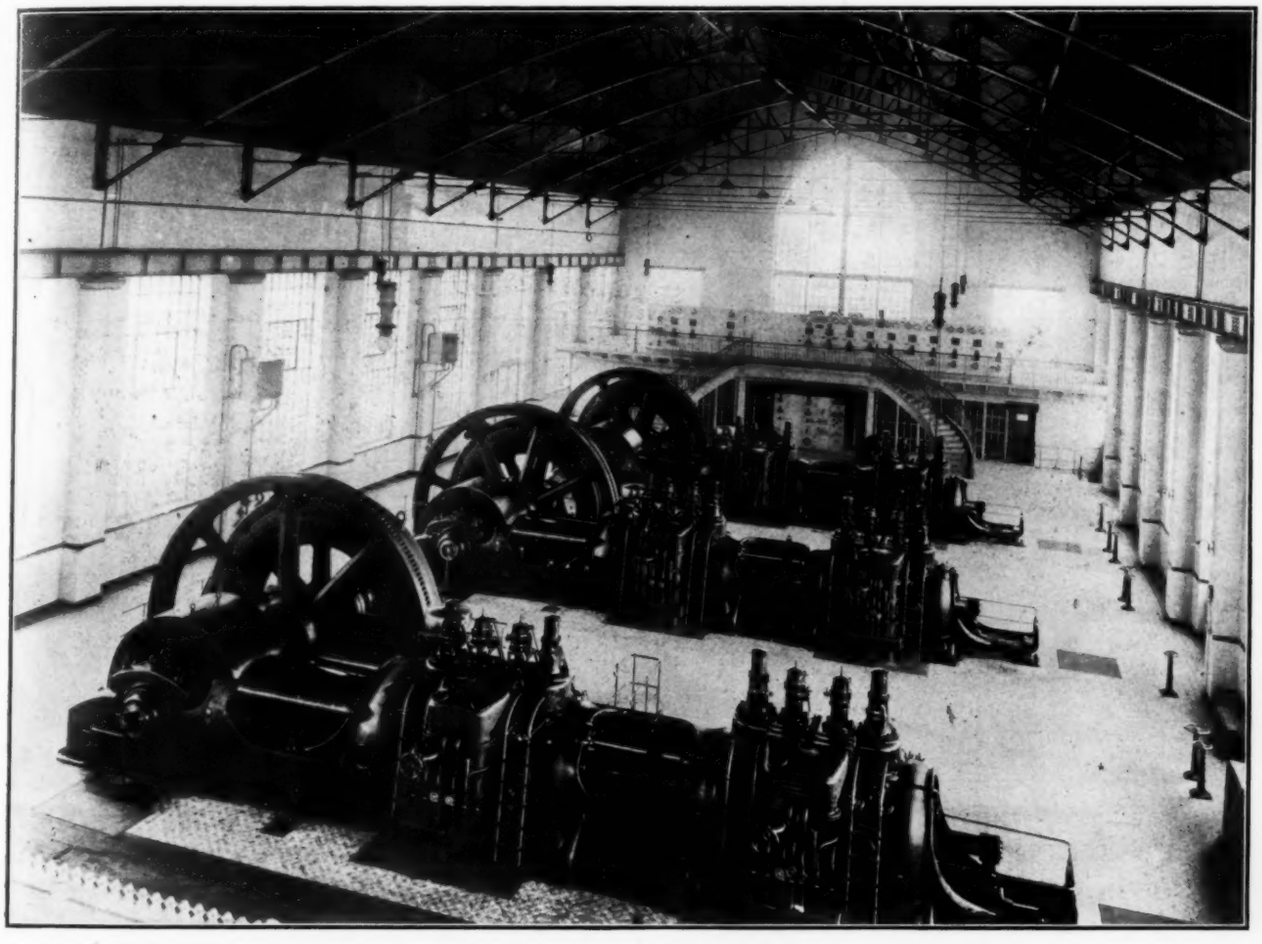
An Economical Gas-Electric Generating Station.

New Plant of the Lens Mine Company, France.

BY C. L. DURAND.

The large electric generating station which has recently been placed in operation by the Lens Mining Company, in the north of France, is a good example of the use of gas-engine units operated by coke-furnace gas. The present company is one of the largest in the country, and operates mines in connection with blast furnaces and coke ovens. On the premises there are already several electric plants which are steam driven, but the plant with which this article deals was erected more recently in order to make use of the gas coming from 160 new coke furnaces. The Vendin-le-Vieil station, as it is called, not only furnishes the mine plant with electric energy for light and power, but a large amount of current is fed into the power network, owned by the Northern Electric Company, which extends over a wide district, supplying light and power to towns and villages in this industrial region. The electrical equipment of the present plant was furnished by the Société Westinghouse with French-built machines and apparatus.

The plant contains at present three main alternators of 1,000-kilowatt size, driven by gas engines. It is proposed to increase the number of gas-engine sets in the future, so that the station is laid out with this end in view and the plant can be doubled without causing any interruption to the service. The gas engines are of a type which is built by the Augsburg-Nuremburg Machine Company. This engine has already proved a success in Germany and in other countries of Europe, especially for high-power engines which are designed to operate with coal gas or producer gas as fuel, as well as gas coming from blast furnaces or coke furnaces. It is especially in this latter field that the use of large gas-engine units is of interest, because of the fact that gases which would otherwise be wasted are now employed for operating electric plants supplying a considerable amount of power for different kinds of metallurgical works. The accompanying illustrations show the appearance of the German-built engines, and in this case they are designed to run with gas coming from the coke furnaces on the company's premises. The present engines are of 1,100-horsepower size,



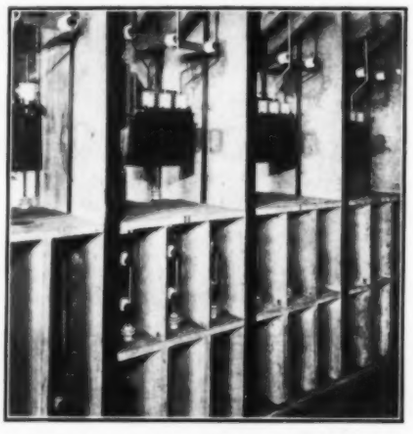
GENERAL VIEW OF POWER HOUSE.

horizontal-type, four-cycle with two cylinders in tandem. They operate at the standard speed of 107 revolutions per minute and each unit is provided with a twenty-seven-ton flywheel 19.5 feet in diameter.

On account of the fact that the Lens Mining Company possesses several other plants supplying the same network, equipped with various types of steam engines or turbo-generator groups, the gas-engine sets had to be designed so that the alternators could be run in parallel upon the circuits under the proper conditions. Thus in the present station the three machines are coupled in parallel, and the plant itself is to be operated, when necessary, upon the common network along with the other stations.

The gas engines are fitted with spark igniters, which are supplied by two small storage batteries each giving sixty volts. The batteries are charged by two booster sets, each consisting of a non-synchronous motor and a direct-current generator giving eighty volts at the maximum. One of the storage batteries is in service while the other is being charged, so as to have a continuous working. Compressed air is used for starting up the gas engines. A supply of air is always on hand and is stored in two air tanks placed in the basement. A three-phase motor drives an air compressor, which keeps the tanks always charged up to standard pressure.

The alternators are of French design and construction and were built at the Westinghouse Company's shops at Havre. They are designed to give three-phase current at 5,000 volts and fifty cycles, operating at the engine speed of 107 revolutions per minute. The revolving part forming the field has a cast-iron flywheel portion in a single piece and carrying eight radial arms These machines have fifty-six poles. The field is excited at 125 volts.

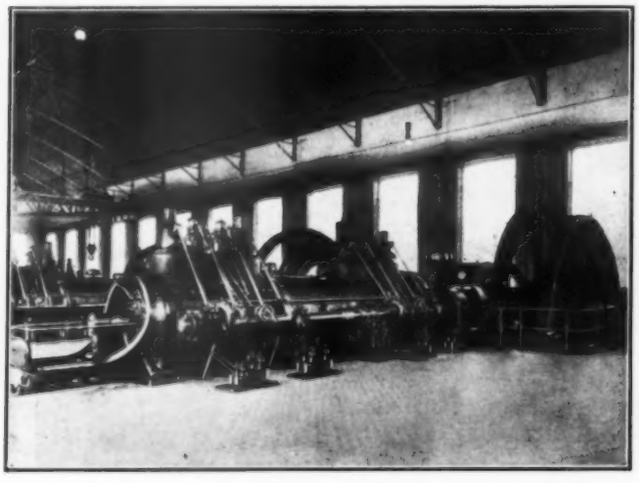


CELLS FOR HIGH-TENSION APPARATUS.

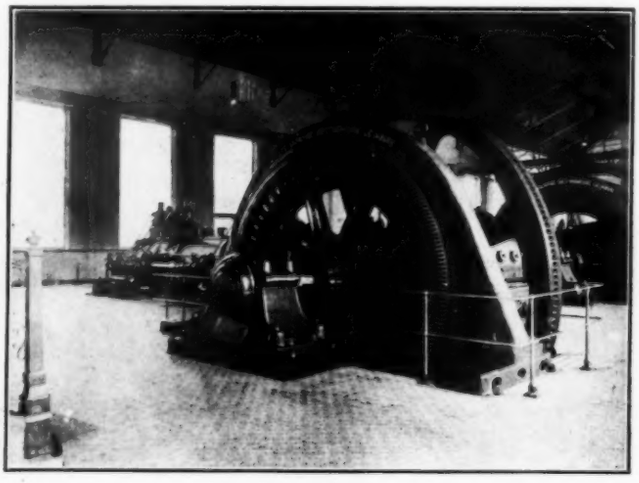
A point of interest in connection with these alternators is the use of a system patented by M. Maurice Leblanc, a well known Paris engineer, permitting them to operate in parallel under conditions such as were mentioned above, and at the same time avoid as much as possible the effects due to resonance. To this end the machines are provided with extra windings, wheh serve to dampen the resonance oscillations and to suppress the harmonics. The poles are divided into eight equal sectors, each corresponding to an angle of forty-five degrees, and carrying alternately a number of large slots for resonance deadeners and small slots for harmonic dampeners. The sectors are thus distributed so as to avoid any bad effects due to unbalancing of the system either mechanically or electrically. In the large slots are laid copper bars of high conductivity so as to form a squirrel-cage winding about the field. In the small slots are used small aluminum rods. For each case the end connections are made by suitable pieces of the same metal. It is found that this method serves the purpose very well. The alternators are designed to take a fifty-per-cent momentary overload.

The two exciter groups of the plant are located near the main switchboard, these being rotary groups of the Westinghouse type. Each of the sets is of sufficient size to excite all three alternators, so that there is always one group as a reserve On the same shaft are mounted a non-synchronous three-phase motor and a direct-current generator. The motor is of 100-horse-power size and operates on a standard pressure of 200 volts, with a normal speed of 970 revolutions per minute. The generator is of sixty-five-kilowatt size and delivers 125 volts at the above speed. Suitable transformers are provided for supplying the motors of the exciter groups, and these are located in the basement. The transformers are of 100-kilowatt size, oil type. Two of them serve for the exciters and a third is used to supply 200-volt current for lighting the premises, as well as for the above mentioned storage-battery charging sets and for other purposes.

The switchboard of the station is laid out so as to handle the different machines and transformers, and to allow of working in parallel with an already



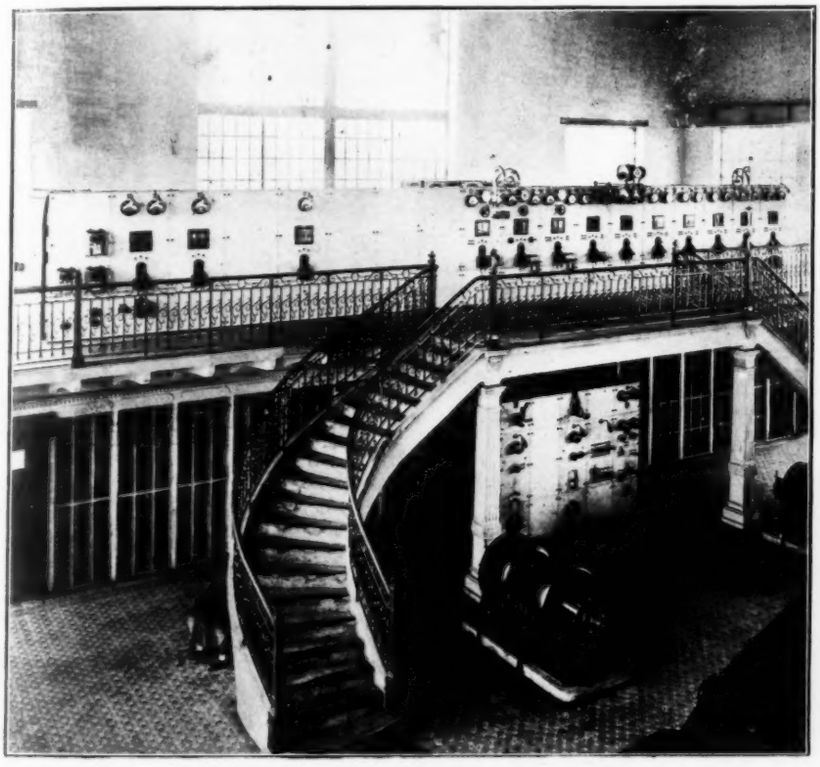
GAS-ENGINE SET.



ALTERNATOR.

existing station known as the Belfort plant, besides providing for six 5,000-volt outgoing feeders to the power network of the Northern Electric Company. As will be noticed in one of the views the 5,000-volt circuits, including the busbars, are mounted in frames consisting of cement cells and occupy the level of the machine room, with a portion also in the basement. On an upper gallery is the marble panel board, which carries only low-tension apparatus for measurement or distant control.

In the view of the high-tension apparatus is seen the reinforced-concrete cell construction. Cables come from the alternators to this point. The cells



MAIN SWITCHBOARD, WITH PANELS FOR EXCITERS BELOW.

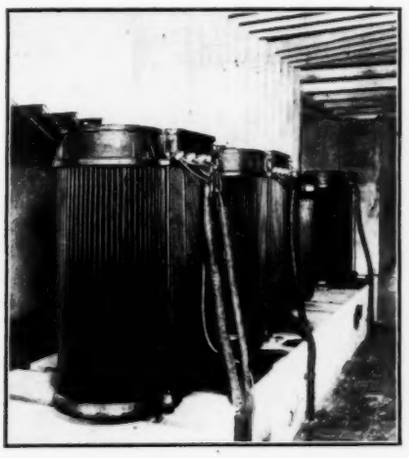
open both ways to the machine room and also into a wide passageway. On the far side are the cells for the busbars, and back of this is a second passageway. The cables from the alternators end at junction boxes and are separated into three different circuits corresponding to each phase. Each circuit passes up to a measuring transformer and a distant-controlled oil switch, going thence above the passage and to the busbar cells. Here are the switches for throwing on to one or the other set of bars, as these latter are double. The present design is used so as to allow the operator to see the position of the main switch when he wishes to make connections at the busbars. On the side next the machine room, the cells are closed off by removable panels of reinforced glass. Back of the busbars is the second operating space, around which are mounted the connecting cables of the busbars in vertical planes, so as to avoid crossing.

The transformers are mounted in the basement floor and below the machine-room level. In the present station transformers are used only for the local service and are three in number at this date, being of the 100-150-kilowatt size, as above mentioned. As they are placed upon rollers, they can be readily shifted to the rear and run out upon a truck which passes along this part.

Referring to the main frame carrying the high-tension apparatus, one part of it is occupied by the machine circuits, as above noted, while another part lying on the same level is used for the starting point of the feeders, with various instruments and a set of busbars lying in the rear analogous to the above arrangement. From the main floor the feeder circuits pass down into the basement floor and connect with choke-coils, switches, and other apparatus placed in a set of cells, ending in the underground feeder cables which leave the station.

Overlooking the dynamo room is the marble panel board mounted in the upper gallery. The measuring instruments on the panels are supplied at low tension from the instrument transformers mentioned above. The switch levers are connected by long rods which pass down to the high-tension oil switches on the floor below. On the main gallery are eighteen marble panels, and the rest of the board consists of five panels placed underneath on the level of the dynamo room, also one panel mounted in the basement. The eighteen main panels comprise one panel for registering instruments, two panels for exciter transformers, one for reserve, one panel for local service transformer, three blank panels for future alternators, three panels for present alternators, one coupling panel for the Belfort station, six feeder panels.

As to the board which is mounted on the machine room floor, it has five panels. Two of these serve for the two exciter sets, with a blank panel for an extra set. The fourth panel is used for the station lighting and the fifth for the motor ignition and storage-battery circuits. The panel in the basement serves for handling the small motors of the station.



TRANSFORMERS.

The connections from the alternator groups to the switchboard are in armored 5,000-volt cable, mounted on insulators on the basement ceiling. The exciters are connected by cable in the same way. In the basement are also the piping for the gas engines, the rotary groups for battery charging, and an air-compressor group with storage tanks.

ON THE USE OF EXPONENTS IN EMPIRICAL EQUATIONS FOR IRON LOSS.

BY P. G. AGNEW.

It has long been known that an equation of the form

$$W = KB^c$$

where B is the flux, W the loss, and c and K are constants, will not accurately represent either the hysteresis loss or the total iron losses, and so it has become customary to speak of the exponent as varying slightly so as to force the equation to fit the experimental values. Numerous determinations have been published to show that the value of the exponent originally given by Steinmetz of 1.6 is only a sufficiently good mean for use over the limited range of inductions used in the design of power transformers, and that not only different kinds of iron give different values, but that for the same sample of iron the exponent varies with the induction.

Unfortunately, however, the methods that have been universally used to determine the exponent have depended upon the implicit assumption that the exponent is a true constant, and hence the values obtained are not actually exponents, but are, in most cases, the logarithmic derivative of W with respect to B, and this becomes the exponent only in the case where it is a constant. In order to make the matter clear it will be well to consider first the methods that have been used to obtain the exponent from the experimental values.

The method most generally used at present is to plot W against B on logarithmic paper and measure the slope of the resulting curve at various values of B. Still considering c a constant, if we differentiate the equation $W=KB^c$, first taking logarithms of both sides, we get

$$log\ W = log\ K + c\ log\ B$$

$$d\ (log\ W) = c\ d\ (log\ B)$$

$$c = \frac{d\ (log\ W)}{d\ (log\ B)} \qquad (1)$$

which shows that c is the slope of the logarithmic curve. An equally accurate but less convenient method may be used with ordinary cross-section paper. Equation (2) may be written in the form

$$c = \frac{\frac{d\ W}{W}}{\frac{d\ B}{B}} = \frac{B}{W}\frac{d\ W}{d\ B} \qquad (2)$$

from which the value of c at any point of the curve is seen to depend upon the values of W, B, and the slope of the curve at the point. Another method which is often used is to solve for c from the values at two points of the curve. Thus if

$$\left.\begin{aligned} W_1 &= K\ B_1{}^c \\ W_2 &= K\ B_2{}^c \end{aligned}\right\} \qquad (3)$$

then

$$c = \frac{log\ \frac{W_1}{W_2}}{log\ \frac{B_1}{B_2}} = \frac{log\ W_1 - log\ W_2}{log\ B_1 - log\ B_2} \qquad (4)$$

Common logarithms may be used in either (1) or (4).

None of these methods is correct if we are dealing with a variable exponent, for then in differentiating to get (1) and (2) we should have had to take account of the variation of c with respect to B, and evidently (4) could not have been deduced at all since we should have had different values of c in (3). This will appear more clearly in an examination of the general case in which

$$W = K\ B^z \qquad (5)$$

where the exponent z is now a variable. It may first be said that suggestions have been made that K should be considered to vary so as to fit the observations to some sort of a curve, and some writers have even treated both the coefficient and the exponent as variables, which is manifestly absurd. To consider that we have an exponent which varies slightly about a mean introduces complications, as will be shown, which greatly limits its usefulness, while any attempt to treat such a formula containing a variable coefficient can accomplish nothing, since in its very simplest form the exponent would reduce to unity, which merely brings us back to the measured values of B and W.

To determine, then, the relations which follow by treating the coefficient as constant and the exponent as a variable, write (5) in the logarithmic form,

$$\log\ W = \log\ K + z\ \log\ B$$

Differentiating,

$$\frac{\frac{d\ W}{W}}{\frac{d\ B}{B}} = z + B\ \ log\ B\ \frac{dz}{dB} \qquad (6)$$

The left member of this equation is the logarithmic derivative of W with regard to B, or the slope of the curve obtained by plotting W against B on logarithmic co-ordinate paper. If z is a constant the last term becomes zero, the curve becomes a straight line, and the slope of the logarithmic curve is the exponent. But if z is not constant this shows that *the logarithmic derivative is not the same as the exponent,* as is

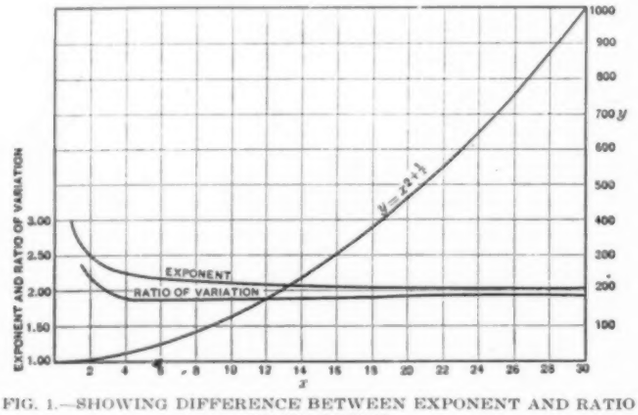


FIG. 1.—SHOWING DIFFERENCE BETWEEN EXPONENT AND RATIO OF VARIATION.

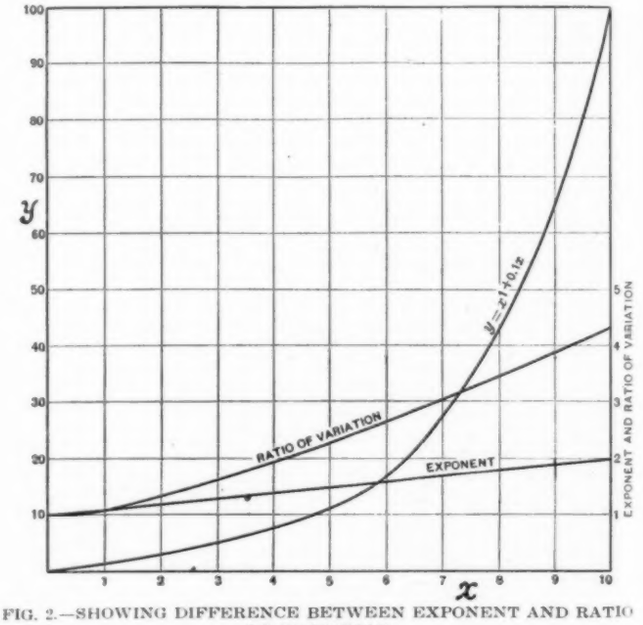


FIG. 2.—SHOWING DIFFERENCE BETWEEN EXPONENT AND RATIO OF VARIATION.

tacitly assumed in the methods in common use in the determination of the exponent where the latter varies. The last term in (6) is entirely neglected in the methods which make use of either logarithmic or ordinary co-ordinate paper, as what is measured in these cases is merely the logarithmic derivative. Similarly the method of solving for the exponent by using values at two points of the curve will not give even the average value of the exponent over the range taken.

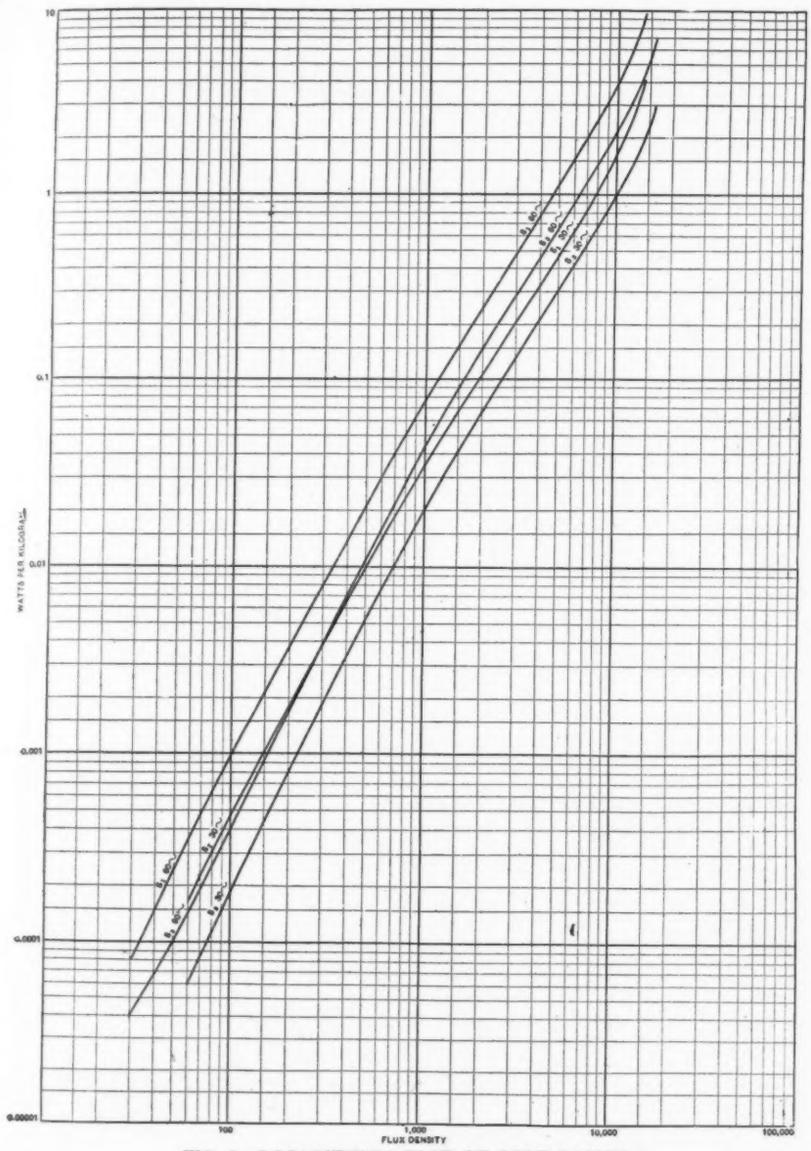


FIG. 3.—LOGARITHMIC PLOT OF CORE LOSSES.
S_1 is Ordinary Steel. S_2 is Silicon-Steel.

The slope of the logarithmic curve is, however, of much more practical importance than the true exponent, for the greatest use of such empirical relations is as interpolation formulas. And the logarithmic derivative is an exceedingly convenient form for interpolation, since for small variations it is the ratio of the percentage change in the dependent variable to the percentage change in the independent variable. The same confusion of it with a true exponent has developed in many similar experimental relations, such as, for example, the variation of the candlepower of lamps with voltage or with current or with the power supplied, and the variation of the resistance of fluids to objects moving through them. Such a confusion of terms is very unfortunate, since it may lead to wrong conceptions. For example, in the case of incandescent lamps some of these logarithmic derivatives have numerical values very near the exponents in some of the theoretical radiation formulas, and it is misleading to express the relationship in exponents or powers of the dependent variable when the approximate agreement in numerical values may be entirely accidental.

It seems, therefore, advisable to have some simple expression which will of itself convey the meaning and be free from the objections that have prevented the common use of the term "logarithmic derivative," and I shall hereafter refer to this quantity as the "ratio of variation." For the suggestion of this term I am indebetd to C. E. Van Orstrand.

In order to bring out graphically the differences that may exist between the exponent and the ratio of variation in geometrical curves of the general parabolic form and whose exponents are of the order of magnitude of those met with in iron losses, in Fig. 1 the curve

$$y = x^{2+\frac{1}{x}}$$

together with the exponent, and the ratio of variation have been plotted. In Fig. 2 the curve $y = x^{1+0.1x}$ together with the exponent and the ratio of variation are plotted. It will be seen that when the exponent is 2 the ratio of variation is 4.3. It happens that the curve for the ratio of variation for this purely mathematical curve is very much like one recently published for the hysteretic exponent for silicon-steel at high inductions in which values as high as 3.6 were given,[1] but as the method used in determining the "exponent" was to take the slope of the loss curve plotted on logarithmic co-ordinate paper, evidently the quantity actually determined was the one here designated as the ratio of variation. Very probably the exponent as determined by methods to be explained presently would not have been greater than 2. The data given were insufficient to determine this point.

Since the last term in equation (6) is positive it follows that the ratio of variation will be greater than the exponent when the latter is increasing, and less when the exponent is decreasing. Consequently the exponent curve lies above in Fig. 1 and below in Fig. 2.

If in the case of a curve whose exponent is changing slowly we choose two points of reference and solve for the exponent as if it were constant, one might expect to get a value somewhere near the mean of the actual values at

1 W. J. Wooldridge, *Proceedings American Institute Electrical Engineers*, 30, page 139, 1911.

the given points, but such is not the case. It may be either greater or less than the actual value at either limit, according to circumstances. A more surprising result of the variation of the exponent is the effect that such a method has in making large changes in the coefficient. For example, if we consider the curve of Fig. 2 as an experimental curve and attempt to determine the coefficient and exponent by this method, which is the one that has been most frequently used in discussing changes in the Steinmetz exponent, we get the following results:

Limits used	Actual curve at midpoint of range	Computed equation
$x = 6$ to $x = 8$	$y = x^{1.7}$	$y = 0.075\ x^{2.05}$
$x = 8$ to $x = 10$	$y = x^{1.5}$	$y = 0.0137\ x^{2.88}$

The computed exponents are nearly identical with the ratio of variation.

The matter is not, however, so serious as these results indicate at first sight, for while the exponents have increased the coefficient has changed from unity to the small fractions, and either of the computed curves will give fair approximations throughout the small range for which it is computed. Yet it does emphasize the desirability of abandoning the use of the word "exponent" as applied to the results of such processes.

There are special cases in which the exponent may be determined with a fair degree of accuracy. If the ratio of variation is found to be constant over a range large enough to make sure of its constancy, it is in this region also the true exponent, and the coefficient may be calculated; and its value may be used in calculating the exponent at any other point of the curve. It may also be shown that if the ratio of variation passes through either a maximum or a minimum then its value at this point is the true exponent.

In order to get an idea of the change of the exponent and of the ratio of variation over a wide range of flux-densities, the core-loss data, determined by C. J. Huber on two special transformers, are plotted on logarithmic paper in Fig. 3. The cores were of ring stampings and the determinations were made by the wattmeter method at both thirty and sixty cycles. The core was first carefully demagnetized and the measurements made in the order of increasing flux.

The core of transformer S_1 was ordinary transformer steel, while that of S_3 was of silicon-steel. The observed values of the total iron losses are given in Table I. The ratio of variation of the core loss of these transformers at sixty cycles is plotted in Figs. 4 and 5. Taking the ratio of variation as constant at 4,000 lines, the exponents have been calculated and the results plotted in the figures. It is evident from the curves that at high flux-densities the ratio of variation reaches very high values for both the silicon-steel and the ordinary steel, while the change in the exponent above 2,000 lines is extremely slight. The exponent is more nearly constant than the ratio of variation, and after assuming a value at some given point may be determined with a much greater relative accuracy.

The ratio of variation is, of course, independent of the units in which W and B are expressed, but the exponent is dependent upon the units used for B, although it does not depend upon the units in which W is expressed. For, if instead of B we write $\propto B_1$, where $\propto$ is a constant the equation

$$W = K B^z$$

becomes

$$W = K (\propto B_1)^z$$
$$= K \propto^z B_1^z$$

In this form the coefficient contains the variable factor $\propto^z$, which is not to be allowed, for the coefficient must be kept constant if such an equation is to have any useful meaning, as we have seen, and hence in order to keep the coefficient constant the exponent must take a new value.

On the whole, the determination of the actual exponent is of little practical importance. It is much more difficult to determine than the ratio of variation, it depends upon the unit in which the independent variable is expressed, and after it is once determined its use, as in interpolation, requires logarithms even for small intervals. The ratio of variation, that is, the slope of the logarithmic curve, is much more convenient to use in interpolating over small intervals. The fact that a constant exponent is the same as the ratio of variation has led to a failure to distinguish between them when the exponent is not constant, and this has introduced considerable confusion, not only in the literature of iron losses, but in the other fields in which the same ideas are made use of. Many attempts have been made to measure the variation of the exponent by methods which assume a constant exponent.

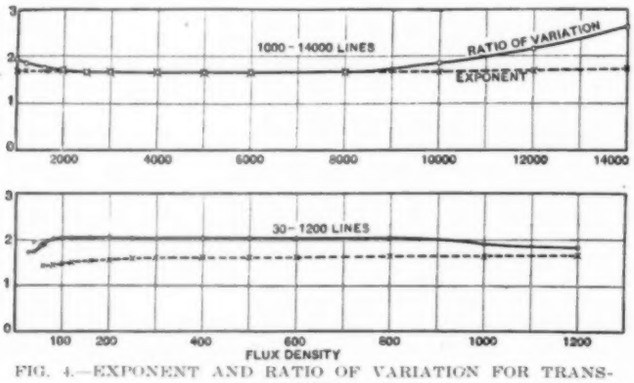


FIG. 4.—EXPONENT AND RATIO OF VARIATION FOR TRANSFORMER S_1.
Ordinary Steel.

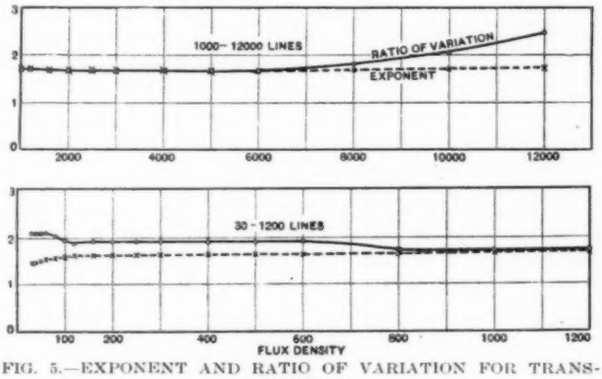


FIG. 5.—EXPONENT AND RATIO OF VARIATION FOR TRANSFORMER S_2.
Silicon-Steel.

TABLE I.—TOTAL IRON LOSSES (WATTS PER KILOGRAM).

Flux	Transformer S_1, ordinary steel		Transformer S_3, silicon-steel	
	30 Cycles	60 Cycles	30 Cycles	60 Cycles
30		0.000080		0.000040
40		.000145		.000050
50		.000235		.000092
60	0.000158	.000353	0.00006	.000135
80	.000294	.000632	.00011	.000256
100	.000458	.000971	.00018	.000390
120	.000666	.00139	.00027	.000570
160	.00116	.00242	.00052	.00103
200	.00179	.00375	.00079	.00167
250	.00272	.00585	.00126	.00270
300	.00385	.00807	.00185	.00385
400	.00653	.0140	.00330	.00694
500	.00985	.0214	.00518	.0109
600	.0140	.0298	.00762	.0154
800	.0233	.0505	.0131	.0271
1000	.0344	.0751	.0199	.0418
1200	.0468	.104	.0282	.0590
1600	.0757	.171	.0465	.0993
2000	.108	.248	.0680	.147
2500	.154	.358	.0988	.214
3000	.207	.484	.133	.290
4000	.324	.776	.210	.464
5000	.466	1.14	.302	.676
6000	.630	1.55	.406	.914
8000	1.15	2.56	.671	1.48
10000	1.73	3.92	.980	2.20
12000	2.56	6.14	1.39	3.11
14000	4.12	9.42	2.05	4.73
16000	5.02		3.01	6.83

Recently Richter[2] has proposed a two-constant formula to supplant the classical form, using only the first power and the square of B so as to avoid fractional exponents. It is of the form

$$W = aB + cB^2$$

where a and c are constants. Jouaust[3] has commented favorably on it. It is easily seen that the ratio of variation for iron whose losses follow such a law cannot be greater than two. It may also be seen that if we plot the ratio of variation against B the resulting curve slopes upward throughout, and hence has neither maxima nor minima.

Although Richter's formula may be very useful when applied to the relatively narrow limits of flux density used in commercial transformer design, it will evidently not meet the requirements over such wide ranges as shown for the transformers S_1 and S_2 in Figs. 4 and 5.

Although there is need for a systematic study of iron losses at moderate and low flux-densities, the data available being neither comprehensive nor systematic, at least nine other observers have reported values of the Steinmetz exponent as great as or greater than two. As in nearly every case increasing or decreasing values of the "exponent" are reported, the values may be interpreted reasonably as the ratio of variation.[4]

German Society of Electrical Engineers.

The national society of electrical engineers in Germany, known as the Verband Deutscher Elektrotechniker, has 4,842 members and 22 sections. It has a large number of committees dealing with standardization and other matters, the two most recently appointed dealing with switching apparatus and heating appliances, respectively.

The annual convention was held this year in Munich; in 1912 Leipsig will be the meeting place.

At the meeting this year, the representatives on the International Electrotechnical Commission reported in favor of adopting the symbols E, I, and R for electromotive force, current and resistance, in order to secure international uniformity. This was ratified by the society and is likely to become international practice.

2 *Electrotechnische Zeitschrift*, December 8, 1910.

3 *La Lumiere Electrique*, 13, page 341, 1911.

4 A more detailed discussion will shortly appear in the *Bulletin of the Bureau of Standards*, Vol. 7, No. 3; Reprint No. 164.

Magnetic Testing of Iron and Steel.

At the annual convention of the American Society for Testing Materials, held at Atlantic City, N. J., June 27 to July 1, a report was submitted by the Committee on Magnetic Testing of Iron and Steel, which recommended standard tests for core loss and normal induction.

The test for core loss is made according to the Epstein method, with minor modifications. The test for normal induction is based upon work done at the Bureau of Standards by C. W. Burrows, who is chairman of the committee.

With slight amendments made at the meeting, this report will be submitted to the Society for action by letter ballot. The final form of the proposed standard is given below.

PROPOSED STANDARD MAGNETIC TESTS OF IRON AND STEEL.

Core Loss.—The power consumption in electrical sheet steel when subjected to an alternating magnetization is known as the core loss. The standard core loss is the total power in watts consumed in each kilogram of material at a temperature of 25 degrees Centigrade, when subjected to a harmonically varying induction having a maximum of 10,000 gausses and a frequency of 60 cycles per second, when measured as specified below. It is represented by the symbol $W_{10/60}$.

The aging coefficient is the percentage change in the standard core loss after continued heating at 100 degrees Centigrade for 600 hours.

The standard core loss shall be measured under the following conditions.

The magnetic circuit consists of 10 kilogram (22 pounds) of the test material, cut with a sharp shear into strips 50 centimeters long and 3 centimeters wide, half parallel and half at right angles to the direction of rolling, made up into four equal bundles, two containing material parallel and two containing material at right angles to the direction of rolling, and finally built into the four sides of a square with butt joints and opposite sides consisting of material cut in the same manner. No insulation other than the natural scale of the material (except in the case of scale-free material) shall be used between laminations, but the corner joints shall be separated by tough paper 0.01 centimeter (0.004 inch) thick.

The magnetizing winding shall consist of four solenoids surrounding the four sides of the magnetic circuit and joined in series. A secondary coil shall be used for energizing the voltmeter and the potential coil of the wattmeter.

These solenoids shall be wound on a form of any non-magnetic non-conducting material of the following dimensions:

Inside cross-section 4 by 4 centimeters
Thickness of wall...not over 0.3 centimeter
Winding length.....42 centimeters

The primary winding on each solenoid shall consist of 150 turns of copper wire uniformly wound over the 42 centimeters. The total resistance of the magnetizing winding shall be between 0.3 and 0.5 ohm. The secondary winding of 150 turns of copper wire on each solenoid shall be similarly wound beneath the primary winding. Its resistance shall not exceed one ohm.

A voltmeter and the voltage coil of a wattmeter shall be connected in parallel to the terminals of the secondary winding of the apparatus. The current coil of the wattmeter shall be connected in series with the primary winding.

A sine-wave electromotive force shall be applied to the primary winding and adjusted until the voltage of the secondary circuit is given by the equation

$$E = 4 f N n B M / 4 l D 10^8$$

in which

f = form factor of primary electromotive force = 1.11 for sine wave
N = number of secondary turns = 600
n = number of cycles per second = 60
B = maximum induction = 10,000
M = total mass in grams = 10,000
l = length of strips in centimeters = 50
D = specific gravity = 7.5 for high-resistance steel = 7.7 for low-resistance steel
E = 106.6 volts for high-resistance steel for sine voltage
= 103.8 volts for low-resistance steel for sine voltage

A specific gravity of 7.5 is assumed for all steels having a resistance of over two ohms per meter-gram, and 7.7 for all steels having a resistance of less than two ohms per meter-gram. These steels are designated as high and low-resistance steels, respectively.

The wattmeter gives the power consumed in the iron and the secondary circuit. The loss in the secondary circuit is given in terms of the total resistance and voltage. Subtracting this correction term from the total power gives the net power consumed in the steel as hysteresis and eddy-current loss. Dividing this value by ten gives the core loss in watts per kilogram.

The Procedure.—1. Cut from the test material a number of strips 3 by 50 centimeters, half parallel and half at right angles to the direction of rolling.

2. Place on the balance a pile of strips weighing 2.5 kilograms. Add a second pile of the same kind, bringing the weight up to 5 kilograms. In each case the weight is taken to the nearest strip. Add in succession two piles of 2.5 kilograms each, of the other kind of strips, bringing the weight up to 7.5 kilograms and 10 kilograms respectively.

3. Secure each bundle by string or tape (not wire) and insert in the apparatus as indicated.

4. Apply the alternating voltage to the primary coil and tap the joints together until the current has a minimum value, as shown by an ammeter in series. Then clamp the corners firmly by some suitable device.

5. Shunt the ammeter and adjust the primary current until the voltmeter indicates the proper value. This adjustment may be made by an autotransformer, by varying the field of the alternator, or by both, but not by the insertion of resistance or inductance in the primary circuit. Simultaneously the frequency must be adjusted to sixty cycles.

6. Read the wattmeter.

7. Calculations. Subtract from the wattmeter reading the instrument losses, which will be constant for any set of instruments and voltage, and divide by 10. The result is the standard core loss.

Normal Induction.—The normal magnetic induction is the induction produced by a magnetizing force in a given piece of magnetic material which has been previously demagnetized and then subjected to many reversals of the given magnetizing force.

Both the induction B and the magnetizing force H shall be expressed in terms of the C. G. S. electromagnetic unit (gauss).

Sheet Metal.—The standard normal induction data for sheet material shall consist of the magnetizing forces corresponding to inductions of 2,000, 4,000, 6,000, 8,000, 10,000, 12,000, 14,000, 16,000, 18,000, 20,000 gausses.

or such as may be obtained without exceeding a magnetizing force of 200 gausses.

The following details are to be observed:

The test material shall consist of five kilograms of the strips cut as indicated for the standard core-loss test.

The magnetic circuit shall be a rectangle having the test material for one pair of opposite sides, and the same or different material for the other pair, which may be shorter. The joints at each corner are alternately butt and lap, or may be clamped on the edges.

The magnetomotive force is applied in two sections. The main magnetizing coils shall consist of two equal and uniformly wound solenoids surrounding the test material. The compensating coils shall consist of two solenoids surrounding the yoke strips.

The test coil surrounds the middle portion of each bundle of test material. Four other test coils of half the number of turns are placed over the test material, approximately midway between the yokes and the center. The two center test coils are joined in series and the four end test coils are joined in series. The corresponding ballistic deflections, due to these two test coils, are measures of the magnetic fluxes through the underlying portions of the magnetic circuit. By connecting the two test coils so that the induced electromotive forces oppose each other, and adjusting the current through the compensating magnetizing coils so that there is no resulting ballistic deflection, an approximate uniformity of flux is secured through the greater portion of the test material, and the induction may be measured ballistically in the regular manner. The magnetizing force when the flux is adjusted to uniformity is that calculated from the uniform winding of the main magnetizing solenoids.

The cross-section of the magnetic circuit is determined as in the standard core-loss test.

Rods.—The standard test for rods for use in electromagnets shall consist of the magnetizing forces corresponding to inductions of 2,000, 4,000, 6,000, 8,000, 10,000, 12,000. 14,000, 16,000, 18,000, 20,000 gausses, or such as may be obtained without exceeding a magnetizing force of 200 gausses.

The standard test for rods intended for permanent magnets shall consist in the measurement of the magnetizing force, the residual induction, and the coercive force corresponding to a maximum induction of 14,000 gausses.

Standard tests shall be made by the Burrows compensated-double-yoke method (described in *Standard Handbook for Electrical Engineers*, and also in *Technical Paper No. 117 of the Bureau of Standards*).

Seat Ordinance in Minneapolis.

An ordinance has been passed in Minneapolis prohibiting street car conductors from taking aboard passengers after all seats were filled and a specified number of persons were standing. The law was, in the beginning, enforced and a street-car crew was arrested for violating it. Since the first arrest the crews have been careful to observe the law, and as a result many passengers were forced to wait as long a time as an hour and a half during rush hours before they could board a car that was not filled to its legal requirements. A large number of complaints have been made against the ordinance and the probability is that it will be repealed.

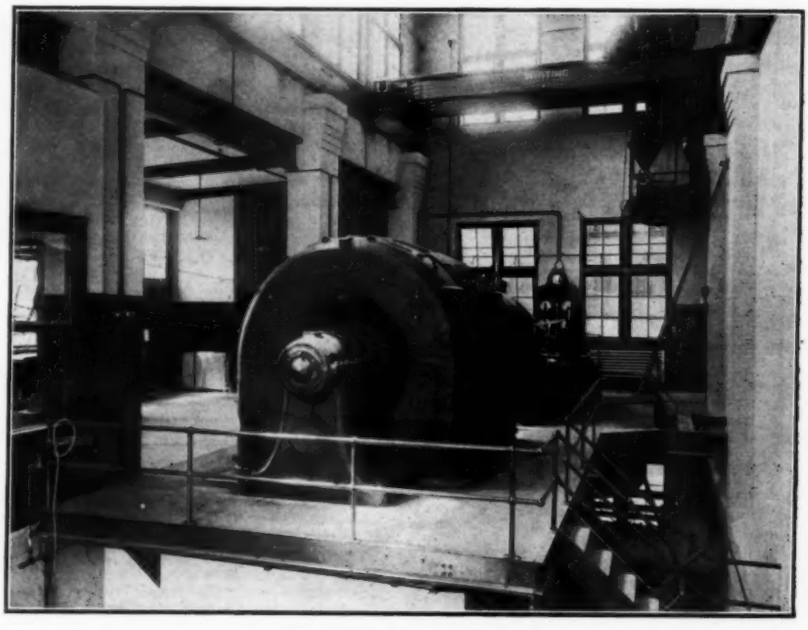
The Jordan Steam Station of the Utah Light & Railway Company.

The Utah Light & Railway Company supplies practically all of the electric service for Salt Lake City, Utah, and during its growth has absorbed a large proportion of the output of the hydroelectric power generating and transmission companies which utilize water powers in the mountain region surrounding Salt Lake City. The increase of the business and the somewhat restricted possibilities of the available water powers have led the management of this company to provide a steam-driven power station, primarily for the purpose of acting as an adjunct to the various hydroelectric transmission systems, and to form a nucleus of such further steam generating equipment as the future may require. The presence of coal measures in the Wasatch Mountains within 40 or 50 miles of Salt Lake City by rail led to an investigation to determine the best site for such a plant, and at this stage of the proceedings Westinghouse Church Kerr & Company of New York were retained to act as engineers and report on the situation. In July, 1909, after considering the advisability of producer gas as well as steam, and the location of the plant at the coal mine, as alternatives, they reported in favor of a steam power station to be located (preferably on the Jordan River) adjacent to Salt Lake City. In the spring of 1910 this report was acted on, and the engineers were authorized to act also as constructors, and to proceed with the design and construction of the new power station.

Among the conditions governing the design of this station were the following: (a) operation not continuous at first; (b) an ample supply of condensing water, unsuitable, however, for boiler feed; (c) feed water to be purchased at a relatively low cost; (d) coal to be brought from mines already developed in Wyoming carrying about 11,700 British thermal units per pound; (e) power-station site consisted of property owned by the Company and having railroad connection.

The fact that the station is not intended to be continuously operated, implies a very low load-factor which called for the exercise of economy in first cost of construction. Accordingly, the building as well as the contained equipment was to be laid out so as to reduce the volume per unit of generating capacity to a very low figure. The cubic contents of the building (which includes ample switchboard room for all the generating equipment it can contain) is fifty-six cubic feet per kilowatt of maximum continuous output.

This station is designed on the so-called "unit system," a unit comprising a self-sufficient combination of boilers, generating units, condensers, and inclosed building, so arranged that it can be uniformly operated either alone or in parallel with the other sections. As



TURBO-GENERATOR UNIT.

The boiler room, which contains six 600-horsepower boilers, is of the same length as the turbine room with its single 10,000-kilowatt turbogenerator, condenser and auxiliaries. It is evident that future needs for greater capacity of this station can be economically met by adding to it one or more units of equipment and inclosing building of the same size as this first one.

The power-station building is of brick, with concrete slab floors and roof. The boiler room includes an overhead coal bunker. This portion of the structure is of skeleton steel construction carrying the greater part of the weight on columns. The turbine room requires no steel framing other than that needed for the roof trusses, floor beams and crane rails. While no money was spent to secure architectural effect, the design is well proportioned and dignified in character.

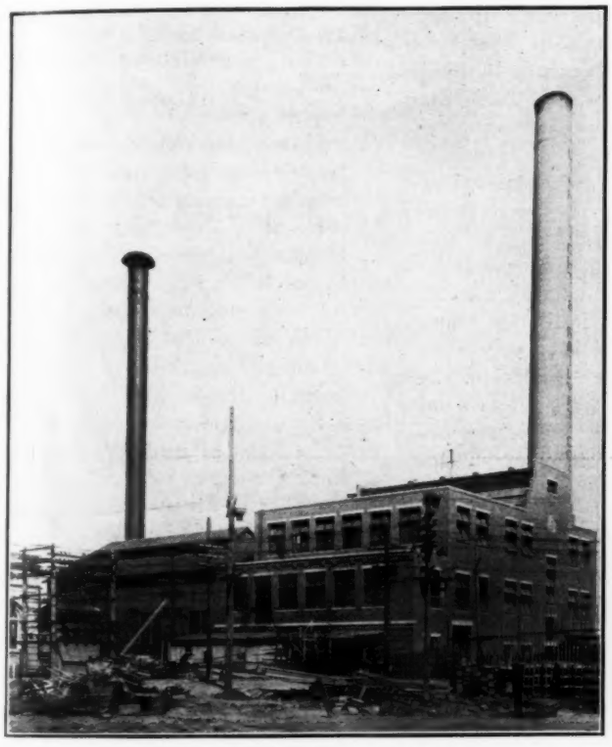
The foundation of this station rests upon a pile-concrete mattress composed of Oregon fir piles thirty-six feet long, spaced 2.5 to three feet between centers, overlaid with a practically uniform thickness of three feet of concrete. The condenser intake and overflow flumes, where within the building line, are formed in the concrete foundation. The main flumes extend from the river bank just outside of and parallel to the building wall, being so placed that they can readily be extended to accommodate future additions to the station, which will be served as in the present case by branches extending from the flumes into the power-station foundations.

The Stirling boilers are fitted with the improved Roney stoker operated by natural draft which is supplied by a single stack. The steam pressure is 200 pounds with 125 degrees of superheat. The arrangement of flues and stack was designed to fit in with the general unit system which will involve the building of an additional stack for every six boilers added to the plant. The boilers next the turbine room are provided with a cross flue running just under the coal bunker, for connecting them with the stack. By means of a system of skylights placed just below the level of the coal bunker, the firing alley between boilers is provided with far better daylight illumination than usual.

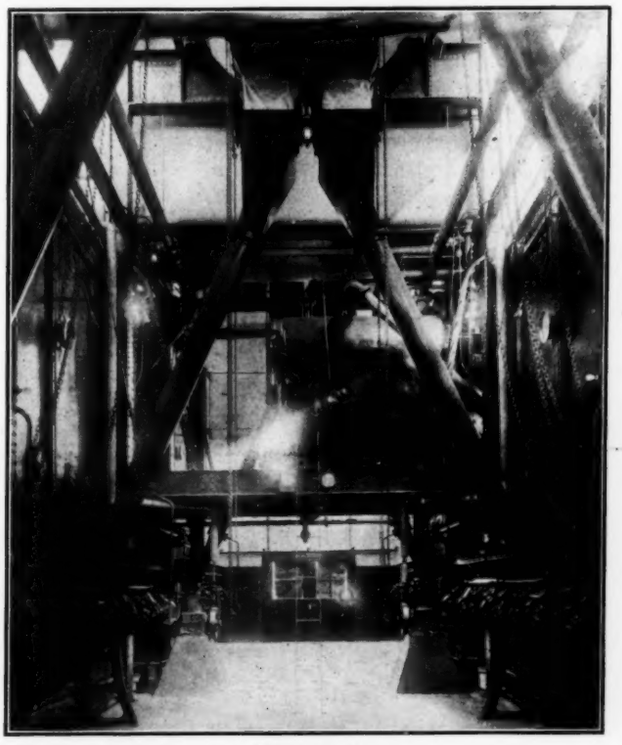
The load conditions at this plant did not warrant the installation of economizers. The stack is of radial brick, 11.5 feet in diameter and 225 feet high. Commercial relationship with the management of the mine rendered it unnecessary to make provision for storing coal on a large scale, thus simplifying the problem of transferring the coal from the railroad cars to the stoker hoppers. The cars dump into a track hopper from which coal is carried up by an inclined bucket elevator to the top of the boiler house at one end, where it discharges on a horizontal belt conveyor by which it is distributed through the bunker over the boilers. The ashes are dumped from the ash pits into side dump cars which run on an industrial railroad in the boiler-room basement and are elevated by a platform lift to the ground level, where they are run out to dump their contents as filling for adjacent land.

The turbo-generating unit is of 10,000-kilowatt continuous capacity, with a temperature rise of not to exceed fifty degrees centigrade. The machine is of the Westinghouse-Parsons semi-double-flow type, runs at 3,600 revolutions per minute, and generates three-phase, sixty-cycle current at a potential of 4,400 volts.

The condensing apparatus is of the mixing type, the LeBlanc condenser, furnished by the Westinghouse Machine Company, being able to show a vacuum of one-half inch to one inch better than the surface type, with similar water temperatures, unless an unusual expenditure is incurred in maintaining the surface condenser. The greater efficiency due to a greater vac-



EXTERIOR OF POWER PLANT.



BOILER ROOM.

uum, combined with the reduced cost of maintenance, more than offsets the increased cost of feed water.

As is the case with other main features of the power-house equipment, the piping is of distinctly modern design and construction. Pipe flanges for high-pressure steam are welded on, and cast-steel fittings and valve bodies are used. The valve seats, disks and spindles are of Monel metal. Particular attention is also given to providing for the expansion and contraction inevitable with high-pressure steam and superheat temperature. The Holly gravity-return system is used in returning condensation in the main steam connections back to the boilers.

The generators are fitted with the usual ventilating ducts. The exciters are of the Westinghouse turbine-driven type of 100-kilowatt capacity. The boiler-feed pumps are steam-driven, of the compound duplex pressure pattern. The air and circulating pumps on the LeBlanc condenser are driven by a small steam turbine.

The switchboard apparatus is contained in a cellular structure of the type now so common in high-tension power stations, being in this instance built of solid concrete. The ring type of bus has been adopted as offering the greatest flexibility in switching combinations of generators and feeders, with the least number of switches installed. The oil switches are General Electric type H-3, electrically operated from a benchboard of the usual type.

Progress in the construction of this station has been remarkably rapid. Active construction began about August 19, 1910, upon the arrival of the first carload of piles. By the middle of October the piles were all in and the concrete wall inclosing the basement was well along towards completion. By November 10 the building walls were nearly finished and the stack well under way. By the middle of December the exterior of the building was completed, the windows were in and the stack was finished. Steam was raised in the boilers on February 6, 1911, the turbine was turned over for the first time on February 15, and the station was reported ready to permanently carry commercial load on March 22, 1911. The entire work of design and construction was executed by Westinghouse Church Kerr & Company, under the direction of O. A. Honnold, electrical engineer of the Utah Light & Railway Company. We are indebted to the former for the illustrations shown herewith.

The Use of Aluminum Field Coils on Traction Motors.

A paper which was read at the International Congress of Brussels by M. A. Mariage, goes into considerable detail regarding the use of aluminum coils in place of copper coils on the fields of street-railway motors. On twenty-five of the cases in which this innovation has been made eight had at the time of the reading of the paper been in operation less than six months, nine less than a year, and eight more than a year, and the trials were to last at least three years. One company equipped 120 motors or one-eleventh of its total number and another placed aluminum coils on its entire equipment of fifty-four motors. A number made use of wire with a square or quadrangular section and others employed circular-section coils. In only one case was rubber insulation used, the others employing bare wire coated with lacquer or bare wire with no insulation whatever. These latter relied entirely on the aluminum oxide for insulation. The insulation between layers on account of the greater voltage drop was obtained by the interposition of various substances such as paper, fiber or cloth.

The specific resistance of copper at zero degrees centigrade is 1.6 and of aluminum 2.7; consequently at that temperature in order that two spools of the same length of wire and the same number of turns, may have the same resistance, it is necessary that the section of aluminum be 1.687 times that of copper. To be more exact, it is necessary to figure from the temperature by the formula

$$R_t = R_o (1 + at + bt^2)$$

According to the results of the most recent experiment, the coefficient b is found to be negligible and the value of a is 0.004 for copper and 0.00365 for aluminum.

Temperature Centigrade.	Resistance of Copper.	Resistance of Aluminum.	Ratio of Resistance of Aluminum to that of Copper.
0	1.6	2.7	1.687
80	2.112	3.488	1.651
100	2.240	3.685	1.645
120	2.360	3.882	1.639

The reduction of weight in spools wound with aluminum wire is always very considerable. The amount of diminution varies between forty and sixty-five per cent of the weight of the copper spool and is generally between fifty and fifty-five per cent of that weight. This economy of weight is advantageous by the reduction of load on the motors and the lessening of the wear on the rolling stock as well as on the track. If we consider a car supplied with two motors of the Thomson-Houston type with two spools of copper wire weighing about thirty kilograms, a reduction of weight of fifty per cent permits a gain, with four spools per motor and two motors per car, of 120 kilograms.

A certain number of cases indicate that the price of aluminum coils is less than that of copper coils, but in general the cases mentioned are summaries and do not exactly indicate the relative cost of manufacture of the aluminum and copper spools.

Particular care should be exercised in the soldering of aluminum wire to the terminals which are to be fixed to the cables of the motor, as this soldering is particularly delicate on account of the formation of oxide on the surface of the aluminum. Also, it is preferable to make the aluminum spool with a single length of wire so as to avoid soldering in the body of the spool. Aluminum presents, in point of view of construction in tramway work, the following advantages over copper: (1) economy of fifty per cent in weight with the same ohmic resistance; (2) the price of purchase and consequently the capital tied up is less. Counting copper at 43 cents per kilogram and aluminum at 49 cents, the purchase price of coils of aluminum would be about sixty per cent of that of coils of copper. (3) The cost of renewing, taking account of the scrap value of old material, is with aluminum about seventy-five per cent of the cost in the case of copper. (4) Although the time of service cannot be definitely fixed it may be considered that less frequent renewal is necessary with aluminum coils than with copper coils of insulated wire. This advantage is due to two reasons: the effect of vibration and shock is less destructive on aluminum coils on account of the lower specific weight; the increase of temperature is much less destructive on account of the elimination of the insulation.

Aluminum has, however, a number of disadvantages. If the cubic contents of the coil is to be kept the same the ohmic resistance of the aluminum spool

would be much greater. There would be also considerably greater heat loss. The matter of soldering has also to be considered.

Before the trial of aluminum on the cars of the Compagnie Générale des Omnibus of Paris, a product called Lemort material was used in the shops for coil-insulation. This product is made of a paste having for its base kaolin and silicate. Considerable trouble had formerly been experienced in the matter of insulation and the spools seemed to undergo extensive deterioration in spite of the care manifested in manufacture at the shop. The cotton insulation used seemed to become charred by heating or worn through by rubbing of the layers against each other.

The later trials made with aluminum wire and Lemort material were more successful, although the results obtained were sometimes variable on account of an insufficiency of aluminum oxide between turns. This paste used for insulation solidified after being applied, and it is found that on measuring coil resistance after this paste has hardened that very seldom if ever is one turn short-circuited against the next turn. The insulation stands shocks without breaking down and has a great resistance to high temperatures.

Summing up, the author said that aluminum presented great advantages over copper in the manufacture of field coils, both regarding economy of weight and of price.—Translated and abstracted from *La Lumiere Electrique.*

Electrical Trade with South Africa.

Exports of electrical machinery from this country to South Africa experienced a material increase in 1910 over 1909, although the figures for cable and wire showed a decrease. The figures shown in the table are from official reports and are given in round numbers:

	1910	1909
Electrical machinery	$355,000	$225,000
Cable and wire	20,000	25,000
Fittings	105,000	75,000
Telegraph and telephone material	10,000	.....

Germany supplies most of the machinery used and the fittings, while the bulk of the cable and wire comes from Great Britain.

Telephones in the Alps.

The monks of St. Bernard, in Switzerland, have fitted the refuge huts in the most perilous spots with telephones, which will enable travelers in distress to ring up for assistance.

LETTERS TO THE EDITOR.

Electrolytic Corrosion.

To the Editor:

In your report of the proceedings and discussions on the several papers delivered at the recent Convention in Chicago, I am quoted rightly as taking part in that on Professor Magnusson's paper on electrolysis. But the remarks you credit to me are only of very small importance compared to what I really wished to convey.

The case in point was this A very interesting account of some severe electrolytic damage done in the space of three years to a cold-storage house in the vicinity of a traction power house, was published in the *Engineering News* about a month ago, by Mr. Harold P. Brown. According to the tests shown to both the officers of the traction company and the cold-storage plant, the damage was not due to the stray currents from the power house, but to the storage company's own electric light plant.

My question was this: Seeing with what thoroughness the Fire Underwriters' rules are being carried out now and how very particular these rules are, how would it be possible for an inspector of the Fire Underwriter's department to pass an installation which would allow of such wholesale destruction to the building?

E. W. Stevenson.

Wilkes-Barre, Pa., July 10, 1911.

Gas and Electric Street Lighting.

To the Editor:

With reference to the correspondence which has been going on in your columns on gas *versus* electricity, the writer has recently received a communication from Mr. F. W. Goodenough of London, England, respecting the statement of Mr. Albert Scheible as to the conditions in that city. Mr. Goodenough states that the 1,000 electric arc lamps are continued in use under a contract which does not expire until 1931.

The large increases in electric lamps were made in districts where the electric light undertakings are municipally owned in spite of lower tenders by the gas company. This is a condition which would hardly be welcomed or perhaps even countenanced in this country, and it would seem as though the electric increases were the result of mismanagement rather than due to the superiority of electricity over gas.

H. Thurston Owens.

New York, N. Y., July 7, 1911.

Future of the Marine Steam Turbine.

The Rede lecture at Cambridge University was delivered recently by the Hon. Charles A. Parsons, who took for his subject "Steam Turbines." In his opening remarks he said that the almost infinite complexity of things had been recognized, and methods based on a co-ordination of data derived from accurate observation and tabulation of facts had proved most successful in unravelling the secrets of nature. About $120,000 was spent in the investigation of the problem of marine propulsion by turbines before an order was received. The first turbine was made by Hero, of Alexandria, 2,000 years ago. In the turbine vessel there was nothing of the disagreeable sensation of the racing of the engines whenever the screw came out of the water in a rough sea. This was because of the great angular momentum of turbines, which is about fifty times that of ordinary engines.

The lecturer produced the pinion of the *Vespasian,* which had covered 24,000 miles and carried 90,000 tons of coal from Newcastle to Rotterdam in all weathers. It was removed from the vessel a month ago, and showed no signs of wear. Half a century ago nearly all screw vessels had mechanical gearing, one element being composed of wooden teeth because the screw revolved at too high a speed for the engines. Subsequently it was found practicable to increase the speed of engines up to that of the screw, and gearing was therefore abandoned. Now very slow speed turbines were found to be incompatible with efficiency, and would probably always be so, and accurately cut steel gearing came to the rescue, and he thought would be a permanent institution as long as steam was used to propel our ships. So satisfactory had gearing proved up to the present that it seemed probable that by its use turbines would be more widely adopted in the future for many purposes. In conclusion the lecturer ventured to predict that the use of the land and marine turbine will be steadily increased, and that the improvements that are being made to still further improve its economy will for a long time enable it to maintain its premier position as a prime mover.—*Engineer and Iron Trades Advertiser.*

The National Electrical Contractors' Association.

The Eleventh Annual Meeting to be Held at Niagara Falls, N. Y., July 19 to 21.

The eleventh annual meeting of the National Electrical Contractors' Association of the United States will be held at Niagara Falls, N. Y., July 19, 20 and 21. It is expected that this convention will be the largest that the organization has ever held as the membership of the association has increased more than eighty per cent in the last twelve months.

The entertainment features will be varied and interesting, and the program thus far scheduled indicates a discussion of pertinent subjects, with a number of able and interesting addresses at the open sessions. The speakers will include F. E. Cabot, Boston, Mass., who will address the meeting on the work of the National Fire Protective Association; Arthur Williams of the Edison Electric Illuminating Company, of New York, who will speak for the National Electric Light Association; Franz Nielson of New York, N. Y., who will speak on the subject of "Credit Protection for Electrical Contractors," and E. E. Whitehorne, of New York, N. Y., who will speak on "Business Getting for the Contractor."

Philip S. Dodd, director of publicity, of the National Electric Lamp Association, will address the contractors, commenting particularly on the usefulness and value from the contractor's standpoint of "Co-operation in the Electrical Industry," followed by general discussion.

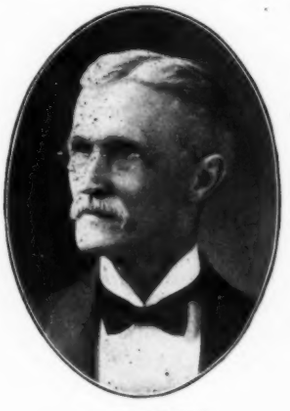
Headquarters will be established at the International Hotel, and there will be open and business sessions on July 19 and 20. Friday, July 21, will be given over to inspection trips. There will be a reception and dance on July 19, a banquet on July 20, and a ball game on July 21.

The National Electrical Contractors' Association was organized in Buffalo, N. Y., July 17, 1901. Prior to this the contractors had gotten together through the medium of the local state and city organizations. The association movement was really started by the formation of local associations in the different cities of New York State, and in August, 1899, these local associations met and formed the United Electrical Contractors' Association of New York State. This organization proved to be so popular, and was of such direct benefit to its members, that in 1901 it was decided to issue a call for a meeting of electrical contractors from all parts of the country, to be held in Buffalo in July of that year.

The meeting was attended by contractors from all over the country, and the inauguration of the National Electrical Contractors' Association of the United States was enthusiastic and gave promise of every success. Since that time, indeed, the organization has grown stead-

C. R. Kreider,
President.

W. H. Morton,
Secretary.



J. R. Galloway,
Treasurer.

G. M. Sanborn,
Director.

James R. Strong,
Director.

J. C. Sterns,
Sergeant-at-Arms.

OFFICERS OF THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

ily, and at the present moment has a membership greater than the most sanguine of its projectors anticipated. The association is representative of contractors in every part of the country, and the organization has been of the greatest material benefit in raising the standard of the business, and has proved a bulwark of strength to the contractors in many of their relationships, both with the manufacturers of electrical apparatus, and the governing bodies of municipalities, where there has been any question of the rights of the contractors with respect to the wire inspection bureaus.

The object of the association is to formulate plans for the equitable carrying out of business in every quarter of the country. Within the past two or three years the membership has grown very rapidly, and it is expected that at the coming convention at least 1,000 members will have been enrolled. There are many matters of extreme importance that are being brought up for attention, and the convention this year will undoubtedly be epoch-making in its discussion of the relation of the contractor to the manufacturers and to the user of electrical utilities.

One of the important features of the association work is the publication of *The National Electrical Contractor*, a monthly journal devoted to the interests of the members of the association and the contractor in general.

The officers of the association are as follows:

President, M. L. Barnes, Troy, N. Y.

First vice-president, Charles R. Kreider, Chicago, Ill.

Second vice-president, H. S. Potter, Boston, Mass.

Third vice-president, J. C. Hatzel, New York, N. Y.

Treasurer, John R. Galloway, Washington, D. C.

Secretary, W. H. Morton, Utica, N. Y.

Sergeant-at-arms, J. C. Sterns, Buffalo, N. Y.

Directors—Illinois: J. T. Marron, Rock Island; Ernest Freeman, Chicago; Charles E. Stapp, Peoria.

Indiana: G. M. Sanborn, Indianapolis.

Massachusetts: Seth B. Wetherbee, Boston.

Michigan: E. McCleary, Detroit.

Minnesota: W. J. Chapman, Minneapolis.

Missouri, W. L. Hutchison, Kansas City.

New Jersey: P. N. Thorpe, Paterson.

New York: James R. Strong, New York City; M. L. Barnes, Troy; James Hilton, Syracuse.

Ohio: J. C. McMaster, Columbus.

Virginia: W. R. Engleby, Roanoke.

First Aid Against Producer Gas.

The Factory Department of the British Home Office has issued a series of instructions for workers concerned with fuel gas under its various names used for gas engines, heating furnaces, boilers, welding, soldering, and the like. They suggest that instructions covering the following points should be posted in the engine room:

1. In starting, the valve to the chimney must be open while the main stop valve is shut. Otherwise, the pressure set up by the starting fan in suction-gas plants will cause escape of gas into the room before the engine begins to turn over.

2. Similarly, as soon as the engine is to be shut down, and its stop valve is shut, the chimney must at once be open so as to allow the gas to escape into the open air.

3. In charging with coal, care must be taken never to put the head directly over the hopper where gas inspired through nose or mouth would be drawn into the lungs.

4. Care must be taken to draw out all air from the gas pipe and the washers so that these spaces would be entirely filled with gas before any light is applied. In the absence of this precaution, explosions are sure to follow. The gas cock must always be closed between tests of the condition of the gas.

5. When cleaning and repairing is to be done, and the fire is extinguished for this purpose, air must be blown through the producer by the fans with the generator doors open. The plant must then be left for several hours before any cleaning is done, so that all gas shall have a chance to escape. Cleaning should be done by daylight, so that no fire or naked light should be allowed near the plant. There must be no smoking. When one of a battery of boilers fired by gas is to be disconnected for cleaning, the disconnection from the gas supply should be complete, either by a long thread or by removing a short piece of the pipe and blanking the flange. When anyone is inside the boiler, a man should keep watch outside.

6. A competent person should inspect all valves and connections to see if there is any leakage, and a record of such inspection, signed and dated, should be kept in the office.

7. No person should be allowed to execute work single-handed in a place where exposure to gas is possible.

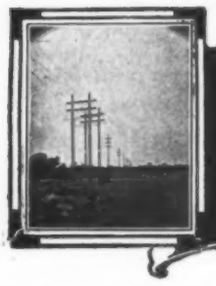
8. Notice should be posted explaining the deadly nature of the gas, the symptoms of poisoning, and the means of rescue. Ropes should be provided for rescue purposes, and the place where they are to be found stated in the notice. The workmen should be drilled in rescue work, and particularly in the procedure of inducing artificial breathing and administration of oxygen. A cylinder of compressed oxygen, with key, nipple, union and rubber tube should always be ready and at least once a month it should be inspected. Two persons in the plant should be in charge of this apparatus and familiar with its use.

9. Men working around gas apparatus should be free from any disease of the heart or lungs. It is especially dangerous to expose one overcome by gas to cold, by reason of the difficult heart action. The muscular weakness which comes from gas poisoning, particularly in the legs, may appear without attracting notice, so that the person affected may be unable to escape. The gas engine should never be located in a confined space, or in a sunk room, or basement. If doors are required to the engine room, they should be cut away at top or bottom, or both. The exhaust pipe or vent should never be inside a building, but always outside, and more than six feet above the ground level.

Value of Ozone.

One of the interesting claims made to further the use of electric ozone-making machines is that the use of ozone in deodorizing the air is of distinct value in the campaign to abolish the common house fly on the score of health. It is pointed out that the fly usually seeks the place where offensive odors are present, apparently attracted by the odor.

The City of Lodi, Cal., which purchases power from the Western States Gas & Electric Company, is planning to purchase an electric baking oven, with the intention of renting it to local bakeries. A.



CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

NOTES ON FUEL ECONOMY.[1]

BY C. E. SHAWFIELD.

The power-house equipment of every central station may be divided broadly under two headings—viz., engine room and boiler house. In the latter the object to be attained is the production of steam with the minimum expenditure of heat units, and in the former the production of electrical energy with the minimum weight of steam. Unfortunately, however, the path from the coal pile to the busbars is of such a devious character and offers so many avenues of escape that comparatively few of the heat units contained in the fuel arrive at their destination in a saleable form. It must be admitted at the outset that the ideal efficiency of 100 per cent is somewhat beyond the limits of practical endeavor; but, nevertheless, it is probable that there are but few power stations where the actual efficiency attained is within an appreciable percentage of the best result which is commercially possible.

It is rather instructive to determine by a few simple calculations what should be the best all-round efficiency of any central station as expressed in pounds of fuel consumed per unit generated, and it will frequently be found that the discrepancy between this calculated figure and the average daily working result is a good deal larger than it ought to be.

The following data are usually available in any central station, and are practically all that are required to form the basis for interesting and useful investigations:

1. The test-bed efficiency of each generating set in the station at half, three-quarters and full load, expressed in pounds of steam per kilowatt-hour. This figure must include all steam used for auxiliaries.

2. The load curve of an average day at different seasons of the year.

3. The efficiency of each boiler, or class of boiler, installed in the boiler house, expressed in pounds of water evaporated from feed to steam per pound of fuel fired. These boiler efficiencies should represent the result obtained under the best conditions; that is, with the boiler clean and in good condition, all brickwork and settings sound and air tight, and assuming careful firing and steady load.

From these data there may be deduced certain standards of efficiency which represent the best results that it is possible to obtain from the plant installed in the engine room and boiler house respectively.

In the engine room the result should be expressed as pounds of steam consumed per kilowatt-hour generated, and in the case of the boiler house as pounds of water evaporated from feed to steam per pound of fuel consumed. These two results, of course, suggest a third—viz., the fuel consumption per unit generated. The figures obtained in this manner will, of course, vary very greatly in different stations under different conditions of generating plant, load-factor and output; but, nevertheless, it will be found that practically every station has a certain "best possible performance" which may be determined from data readily obtainable, with a reasonable degree of accuracy, and these standards once determined are of considerable assistance in tracing and eliminating many sources of loss.

Let it be assumed that the calculations previously referred to have been made, and that certain values have been arrived at which may be, for a fairly average case, as follows:

1. *Engine Room.*—A mean consumption of twenty-four pounds of steam per kilowatt-hour throughout the twenty-four hours under the average conditions of steam pressure, steam temperature, vacuum and load.

2. *Boiler House.*—A mean evaporation of eight pounds of water from feed to steam per pound of fuel consumed.

3. *Deduced from 1 and 2.*—An average consumption of three pounds of coal per kilowatt-hour generated through the twenty-four hours.

In making the above calculations it will be assumed that the supplies of fuel are fairly uniform in their calorific value and in the percentage of moisture and ash contained.

It now becomes necessary to conduct a series of further investigations to ascertain to what extent the actual results obtained compare with the calculated standards, and it is here that the real difficulties are encountered. In the great majority of power stations the consumption of fuel is measured daily or weekly (usually the latter), and compared with the corresponding output of units at the busbars, and a figure is thus obtained which gives the fuel consumption per kilowatt-hour generated. Unfortunately, however, there are but few cases in which it is known with any degree of accuracy what is the mean steam consumption per unit generated, or the average evaporation of water per pound of fuel burnt, and it is precisely these records which are the most valuable when the question of fuel economy is under consideration.

THE ENGINE ROOM.

In the case of those stations which run under non-condensing conditions, or where the generating sets exhaust into condensers of the jet or ejector type, there are certain obvious difficulties in obtaining anything like a continuous record either of the steam consumption of individual sets or of the total steam consumption of the station. Nevertheless, there are two methods in which this may be done with a fair approximation to accuracy. One method is the insertion of steam meters of the disk type in the branch steam pipe to each generating set; the other is by passing the whole of the feed water to the boilers through some form of meter or recorder which gives a continuous diagram on a chart.

If the former method—that is the use

[1] Abstracted from *The Electrician* (London), June 23, 1911.

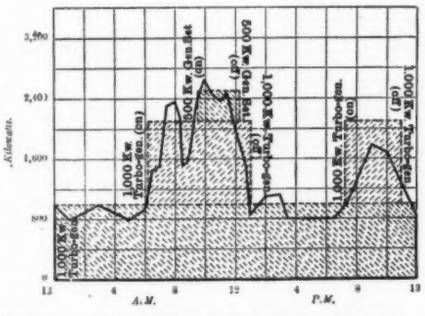
of steam meters—is adopted, it is fairly easy to obtain a continuous record of the performances of the individual generating sets; but some time and trouble is necessary to combine the individual records in order to ascertain the performances of the engine-room plant as a whole, and the risk of error is considerably increased. Since, however, the mean performance of the engine-room plant as a whole is of more importance than the individual performance of any set, better results could probably be obtained from continuous measurements of feed water to the boilers. If this method be adopted it is necessary to see that a constant level is maintained in the suction tank or hot well which supplies the feed pumps, and also that the water in the boilers is maintained accurately at a constant level. If these precautions are adopted the feed input to the boilers will correspond within certain definite limits to the steam output to the engine stop valves, the inevitable discrepancy being accounted for by loss of water through the boiler blow-offs, through condensation in the steam range, and also by loss of steam through the boiler safety valves.

If, as is frequently the case, the whole of the generating sets exhaust into surface condensers, the obtaining of continuous records, either of individual sets or of the total consumption of the engine-room plant, becomes a very simple matter indeed, and the installation of recorders of the V or square notch type will prove to be a very sound investment.

If possible, arrangements should be made for separate measurements to be taken of the steam which has been usefully employed (that is, which has passed through the prime movers and returned through the condensers), and of the steam which is wasted by condensation in the steam range, separators, etc., and which is returned by the traps. The make-up water required by the boilers may also be included under this latter heading.

If it has been possible to obtain a continuous record in the form of a diagram of the steam consumption of the generating sets on any particular day, it is a simple matter to obtain by integration the average consumption throughout the twenty-four hours, and also the actual consumption per hour at any period of the day. The average consumption throughout the twenty-four hours can be calculated and some of the causes of any excess consumption may be ascertained by a careful inspection of the diagram itself. For example, if at any particular hour of the day the actual recorded consumption of steam per kilowatt-hour generated is considerably in excess of the calculated standard, it may be assumed that the set or sets in service at that time are consuming very much more steam than they should be at that particular load, or that the relation of generating sets to load—that is, plant load-factor—is not the best that can be obtained. If the former supposition should prove to be correct, then the obvious remedy is to overhaul the generating sets and their auxiliaries. If, however, the latter assumption is found to be true, then the overhaul is equally necessary in the case of the shift engineers and the running staff.

The plant load-factor has an extremely important bearing upon the question of fuel economy, and a difference of from five to ten per cent in fuel con-



TYPICAL LOAD CURVE SHOWING OPERATING EQUIPMENT.

sumption may readily be occasioned by good or bad arrangement of the apportionment of plant to load. A useful method of checking the abilities of the running staff in this direction is to have plotted on the daily load curve a diagrammatic representation of the amount of engine-room plant in service each hour of the day. An example of such a combined load curve and diagram is shown in the accompanying illustration.

In cases where any excess steam consumption is traced to any particular generating set or sets, indicator diagrams should be taken at various loads and then compared with the original diagrams taken by the makers at the official test. An inspection of these will frequently indicate the cause of the trouble. In reciprocating engines of the high-speed vertical type, the excess steam consumption is often due to wear at the piston valves and rings, or to badly fitting or defective high-pressure piston rings. Inaccurate valve setting is sometimes another source of trouble, although the existence of defects of this description should be apparent on an inspection of the indicator diagram.

In the case of steam turbines the following principal causes of high steam consumption may be looked for:

1. *Blade Stripping.*—Fortunately at the present day cases of blade stripping appear to be less frequent than they were a few years ago, due, no doubt, to the fact that the operation of turbines is somewhat better understood than was formerly the case, and to experience having shown what precautions are necessary to prevent this annoying class of breakdown. Nevertheless, it is quite possible at any time that a partial strip may occur at the high-pressure end of the turbine without giving any external evidence, and several cases have occurred where it was only when the turbine had been opened up that the discovery was made that a more or less complete strip had occurred on several rows of the high-pressure blading.

In the case of turbines of the reaction type, which are more subject to trouble of this description, it will usually be found that the stripping of two or three rows of the high-pressure blades results in a lower steam-chest pressure throughout the whole range of load, and this is an indication which should be looked for should it be suspected that a partial strip has occurred.

2. *Excessive Radial Clearance Owing to the Wearing Away of Blade Tips or Blade Shrouding.*—This is a defect which sometimes arises from unequal heating of the rotor when starting up, resulting in the rotor becoming temporarily distorted and bringing the blade shrouding or blade tips in contact with the shaft and casing. Although very little actual damage may be occasioned by an occurrence of this kind, yet sufficient metal may be removed from the shrouding or blade tips to increase appreciably the radial clearance, with the natural consequence that the steam losses through leakage past the blading are considerably increased.

3. *Steam Leakage Around the Dummy Pistons.*—This is probably one of the most usual sources of loss in steam turbines after they have been running for a year or two, and the presence of this defect, as a rule, can only be clearly established by careful measurement of the actual clearances. Fortunately, it is usually easily remedied by readjustment.

4. *The Partial Choking Up of Rows of Blades by the Deposition of Mud Car-*

ried Over by the Steam.—This condition of things is apparently caused by the carrying over of mineral matter which is held in suspension by the steam, and is gradually deposited on the low-pressure blading. As a rule this deposition does not occur until after the steam has expanded down to atmospheric pressure or below, but once it has commenced the low-pressure blading of the rotor and the casing becomes covered with a fairly hard chocolate-colored mud, until sometimes entire sections of blading are almost completely choked up. The first symptoms of this species of defect are a falling off in the rated capacity of the turbine, together with an appreciable increase in the steam consumption, and the only remedy is a somewhat tedious process of cleaning each individual blade by means of scrapers and compressed air blast. As a means of preventing trouble of this description, care should be taken to see that the concentration of mineral matter in the water contents of the boilers is kept at a reasonably low figure.

It is not very often that excessive steam consumption is due to the auxiliary appliances in the case of reciprocating engines, as this type of prime mover is much less affected by variations of vacuum than is the case with the steam turbine; and, indeed, it is very doubtful whether, in the interests of economy, it is advisable to attempt to obtain a higher vacuum than twenty-four to twenty-five inches in the case of reciprocating engines. Beyond this point very little decrease of steam consumption is effected, whilst any little saving there might be is more than counterbalanced by the lower temperature of the water of condensation, and by the additional power absorbed by the auxiliaries.

So far as steam turbines are concerned, the circumstances are entirely different; here the reduction in steam consumption as the vacuum is improved is very marked indeed, being approximately five per cent for each inch of mercury above twenty-six inches. The condensing plant of a turbo-generator is, therefore, a very important item, and not infrequently the increased steam consumption in the case of turbo-generators may be traced to a fall of vacuum in the condensers, which has not been revealed by the usual gauge. The best form of vacuum gauge is undoubtedly the differential type. These instruments are perfectly reliable, and have the advantage that they always record the true absolute pressure at the condenser, irrespective of barometric variations. Moreover, they are easily made and are not liable to derangement.

If the vacuum in any case is found to be considerably below standard, the causes may be looked for in the following directions, viz.:

1. Air leakage.
2. Air-pump defects.
3. Insufficient supply or too high temperature of circulating water.
4. Choking of condenser tubes with scale or other foreign matter.

In the case of the first three causes the remedy is obvious.

In the fourth case—viz., the presence of scale—an effective method of dealing with it is to circulate dilute hydrochloric acid periodically through the water space of the condenser. When doing this it is necessary to see that both inlet and outlet branches are blanked off or otherwise closed, to prevent the acid reaching the circulating pump on the inlet side or escaping prematurely at the outlet. If the dilute acid is circulated through the tubes by means of a small pump for two or three hours it will be found that practically the whole of the scale is removed and the tubes are left clean and bright.

A careful investigation of the engine-room plant conducted generally on these lines will go a long way towards bringing the actual performance of the station, so far as the engine room is concerned, to a point within reasonable proximity to the standard which has been arrived at by calculation. It now remains to be seen what improvement can be effected on similar lines as regard the boiler-house equipment.

THE BOILER HOUSE.

The first step to be taken is the measurement of the total weight of feed water delivered by the feed pumps, and if possible this measurement should be made in the form of a continuous record, so that it may be compared on a time basis with the corresponding record of steam used in the engine room. The difference between the total quantity of water put into the boilers and afterwards recovered from the condensers in any given period will form the basis for calculating the total number of heat units wasted in blowing down boilers by condensation in the steam pipes, etc., and by the loss of steam through the boiler safety valves. Furthermore, if the measurements be in the form of a continuous record for any period, not only will the total amount of this loss be capable of calculation, but, what is of equal if not greater importance, the time of day at which the greatest amount of loss occurs will also be available.

Armed with this latter information, the task of reducing those losses is considerably simplified. It will sometimes be found that the losses through condensation in the steam pipes, etc., are greater at times of light load than full load, in spite of the fact that under light-load conditions the total weight of steam dealt with is very much less. This may be due to the fact that at light-load periods the rate of flow of steam through the pipes is greatly decreased and the degree of superheat is probably considerably lower.

As a method of reducing these condensation losses, careful attention must be paid to the condition of the lagging, and particularly to the covering of the steam-pipe flanges and valve bodies. Moreover, the application of the bulb of a thermometer to the exterior surfaces of the lagging will in many cases reveal surprising differences of temperature, and will lead to the discovery of defects which might otherwise pass unnoticed.

The number of boilers in use at light load should be reduced to the minimum, the object being to carry the load on one or more boilers working at as nearly as possible their most efficient rate of evaporation, the remainder of the boilers being shut off the range and carefully banked.

The actual hourly evaporation of the boilers, as determined generally from the measurements of boiler feed and of engine-room steam consumption, should be plotted in the form of a curve on a scale diagram showing the number and capacity of the boilers actually under steam for each hour in the day. The capacity of each boiler is to be taken at the rate of evaporation at which it gives the highest efficiency. This curve will indicate the boiler load-factor at any hour in the day, and it can readily be determined whether the boiler-house staff is working the plant under the most suitable conditions or whether fuel is being wasted through several boilers being operated at very inefficient rates for a number of hours in the day.

Unfortunately, it is very difficult to obtain anything like a continuous record of the total coal consumption over any given period, and in the great majority of cases the only method by which it can be arrived at is the somewhat expensive

and laborious one of hand firing every boiler and measuring the total quantity of fuel fed thereto hourly. Nevertheless, even if this method be adopted, the results obtained will be found worth the trouble involved; and if plotted on a chart containing also the load and water consumption curves, the information which may be deduced thereform will prove both interesting and valuable. In the majority of cases, however, the only coal measurements available will be the total quantity consumed daily or weekly, and this figure divided into the total water evaporated for the same period will give the mean evaporation from feed to steam per pound of fuel. Is is to be feared that the figure thus obtained in every-day practice will be very much below the calculated standard, which, after all, represents a standard of boiler efficiency which is only likely to be obtained in a station possessing an abnormally high plant load-factor.

Among the most potent sources of loss in the boiler house generally is the presence of scale or mud on the water surfaces of the boilers, and of soot or other incrustation upon the fire surfaces. In fact, it may be said that the highest possible degree of cleanliness of the inside and outside of the boiler is one of the primary requisites of efficiency.

It seems hardly necessary to refer to the wisdom of careful inspection of the brickwork of the boiler settings and of the flues to insure that air leakage is reduced to a minimum, and that the thickness of the walls is sufficient to prevent undue loss by radiation. In this connection it should be noted that fireclay should not be used in boiler settings, or brickwork generally, unless the temperature is sufficiently high to flux it, otherwise in a short space of time it crumbles away, and loose, shaky brickwork, with all its attendant evils, is the result. Bricks if laid in cement, and if ample time is allowed for the latter to set naturally, will stand very much greater temperatures than is commonly supposed without the slightest deterioration.

If it be found that the boilers generally, the economizers and flues, are in a good condition, it may be assumed that improved efficiency may be looked for in an alteration in their method of operation. In this direction improvement will usually be found obtainable only by constant experiments, by a careful and frequent use of a CO_2 recorder of the Orsat type, and last, but by no means least, by giving the boiler-house staff a practical interest in obtaining improved results.

If, for example, it has been determined that the best possible performance so far as the boiler house is concerned is the evaporation of eight pounds of water from feed to steam per pound of fuel consumed, and that the average performance under normal working conditions is only six and one-half pounds, then a bonus scheme might be initiated somewhat on the following basis:

The bonus to take the form of a percentage increase in wages according to the amount of steam generated per pound of fuel consumed above a certain minimum—that is, no bonus to be paid unless an evaporation exceeding, say 6.6 pounds of water per pound of coal is obtained. For each one-tenth of a pound above this a bonus to be paid to the boiler-house staff as follows:

Evaporation in pounds of water per pound of coal.	Bonus Per Cent.
6.6	Nil
6.7	2½
6.8	3
6.9	4
7.0	5
7.1	7
7.2	9
7.3	11
7.4	13
7.5	15

These figures are, of course, only for the purpose of illustration, and the scale of bonus must necessarily depend upon purely local conditions, such as rate of wages, price of fuel, and also upon what is the maximum degree of improvement likely to be obtained.

The necessary calculations should be got out every week in a tabular form, and the result posted up in the boiler-house; the actual bonus may be paid monthly or quarterly. When making these calculations allowance must be made for the water which is lost by periodical blowing down of the boilers.

It may be, and has been, argued that a bonus scheme of this character is immoral, inasmuch as it attempts to secure by bribery that efficient service which should be freely rendered in return for the normal wages. This may or may not be true, but it is certain that, pending the arrival of the millenium, payment by results will always produce more efficient work than any other method of remuneration.

In conclusion, the writer desires to emphasize the paramount importance of keeping continuous records of boiler-house and engine-room performances, as without such records it is very difficult, if not impossible, to discover and eliminate the many sources of loss, and to maintain a reasonably high standard of efficiency.

Death and Resuscitation from Electric Shock.

The chief causes of death in cases of electrical shocks are fibrillary contraction of the heart and respiratory paralysis, according to E. M. Stanton and A. Krida, in the *New England Medical Monthly*. The ventricular fibrillations take place during the passage of the current and the heart is unable to re-establish the normal rhythm. The maintenance of normal heartbeats largely depends on a full blood pressure in the coronary arteries and when this pressure falls to zero (in about fifteen seconds) resuscitation is hopeless, unless an artificial increase in blood pressure can be induced.

Respiratory failure seems to be due to an anæsthetic condition of the central nervous system and the proper treatment is artificial respiration until the nervous paralysis passes away.

Artificial respiration may be maintained either by manipulation of the body itself in such a manner that the chest cavity is alternately compressed and expanded, or by the use of a pump or a bellows so manipulated as to force air at regular intervals through the trachea into the lungs in sufficient volume to expand the chest and properly fill the lungs, expiration being accomplished by simply releasing the pressure and allowing the chest walls to collapse.

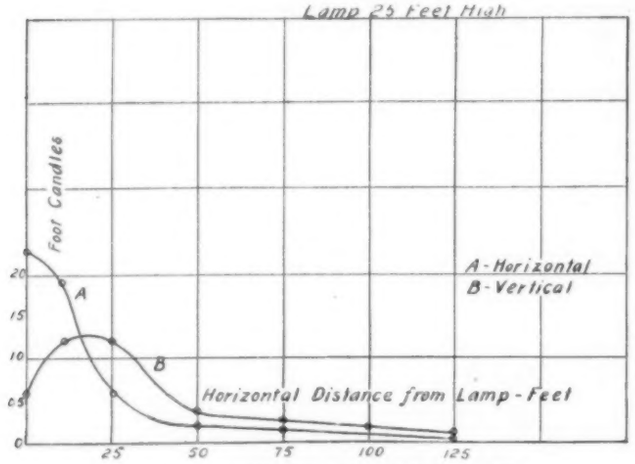
Sollmann was the first to show that ventricular contractions depend upon a sufficient pressure in the coronary arteries, and that the quiescent heart may be made to beat if some fluid, even metallic mercury, be forced into the coronary arteries. Crile and Dolly finally devised a means of producing this necessary pressure in the coronary arteries with the heart *in situ*, as follows: first, the arterial system is rapidly filled with salt solution by injecting the solution toward the heart through a suitable peripheral artery, and at the moment when the arteries are nearly filled, adding a sufficient amount of adrenalin chloride, which causes the vessel walls to contract, and thus rapidly raises the blood pressure within the arteries. At the proper moment the heart is stimulated by a few quick compressions on the chest wall, which cause it to immediately jump into action, beating very vigorously from the first beat.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

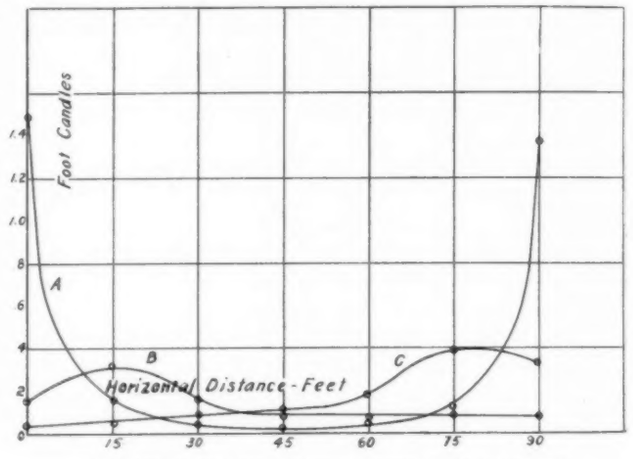
STREET ILLUMINATION.

BY W. T. RYAN.

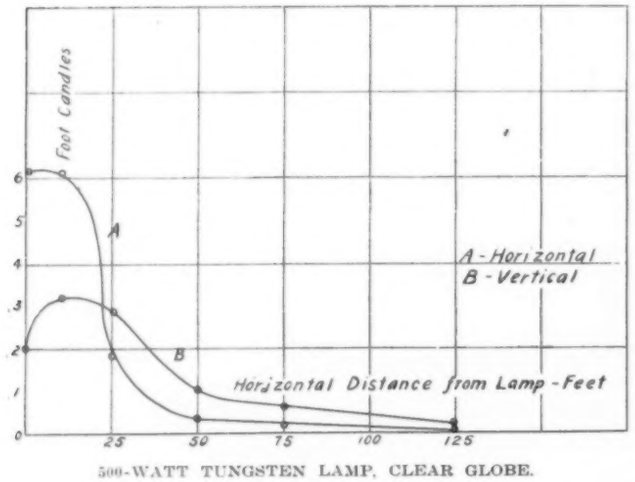
The following street-lighting curves, which were obtained by Messrs. H. C. James and M. J. Hansen, senior electrical-engineering student at the University of Minnesota, as a part of their regular laboratory work, are believed by the writer to be of sufficient interest to warrant their reproduction here.



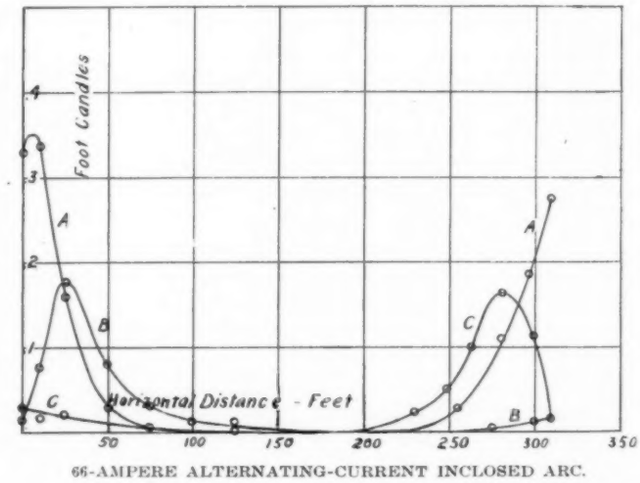
500-WATT TUNGSTEN LAMP, OPAL GLOBE.



ORNAMENTAL FIVE-LIGHT TUNGSTEN CLUSTER.



500-WATT TUNGSTEN LAMP, CLEAR GLOBE.



66-AMPERE ALTERNATING-CURRENT INCLOSED ARC.

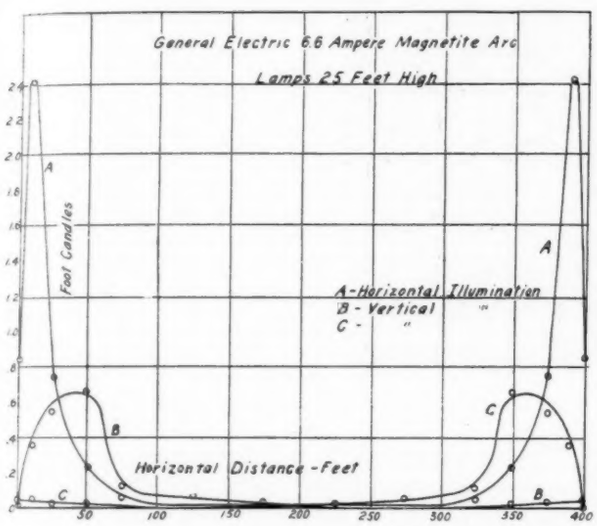
Illumination tests in the horizontal and in two vertical planes were made for eight different systems of street illumination, as found in actual operation at different places in Minneapolis and St. Paul. The measurements were made with a Sharp-Miller portable photometer, which was carefully calibrated immediately before and after the tests. The measurements for both the horizontal plane and the vertical planes were made four feet above the ground.

Unfortunately there is very much disagreement as to the methods of measuring street illumination. Most European engineers measure the horizontal illumination one meter above the level of the street. The British standard is the same except that the test plane is usually taken four feet above the street level. American engineers are divided between four different systems, *i. e.*, the British standard, horizontal measurements at the level of the street, vertical measurements four feet above the street, and measurements normal to the direction of the illuminant. Each standard of measurement has its list of advantages and disadvantages, which accounts for the fact that engineers disagree as to

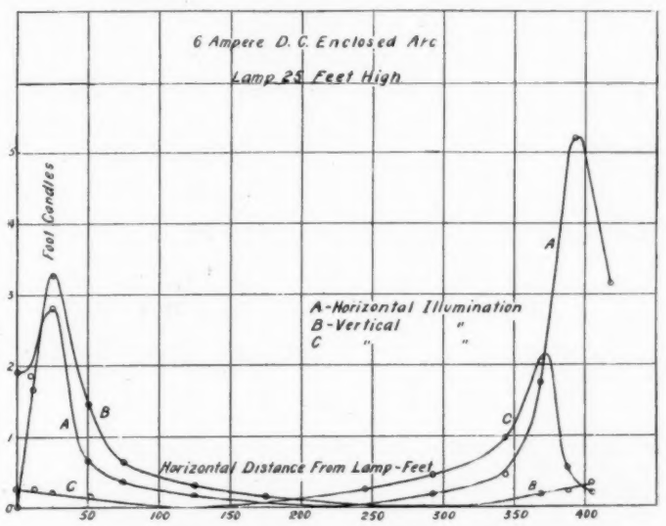
which is the best. The National Electric Light Association (*Transactions*, 1908, Vol. I, p. 580) has adopted normal measurements at a distance of 250 feet as the basis of its standard rating of arc lamps.

Horizontal illumination is undoubtedly much harder to measure but it takes full account of the joint effect of several lamps. The writer believes that a double set of readings such as have been taken in this case, is a very good solution of the problem which is to be solved.

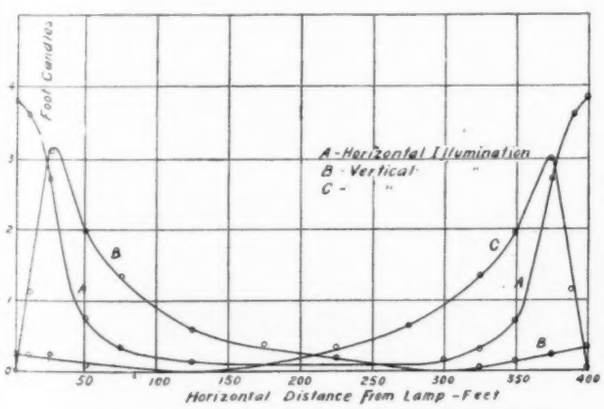
I desire also to call to attention that it was observed to be easier to read



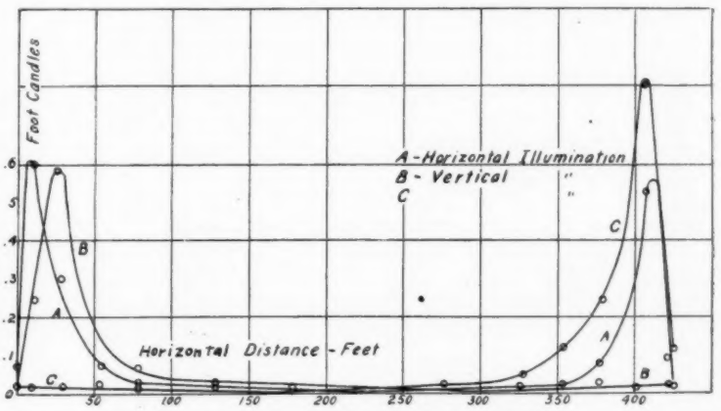
6.6-AMPERE GENERAL ELECTRIC MAGNETITE ARC.



SIX-AMPERE INCLOSED DIRECT-CURRENT ARC.



FOUR-AMPERE WESTINGHOUSE MAGNETITE ARC.



9.6-AMPERE DIRECT-CURRENT ARC.

fine print with a definite number of foot-candles coming from a 500-watt Tungsten lamp than it was when the same measured illumination was obtained from a magnetite arc.

The four-ampere Westinghouse magnetite arc was mounted 38 feet above the ground; all the other lamps were twenty-eight feet high.

New York's Safe and Sane Fourth.

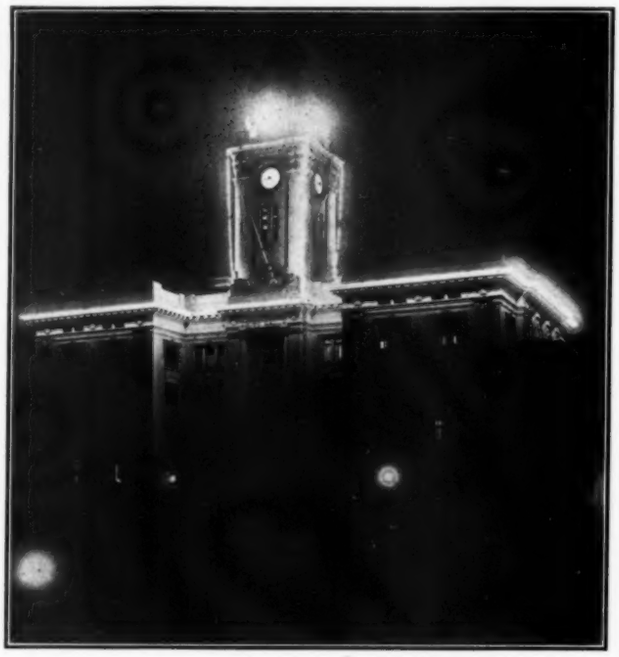
On July 4, 1866, a great portion of the city of Portland, Me., was wiped out by a ten-million-dollar fire which was started by firecrackers. There is not a city or town or hamlet in this country but what has its list of Fourth-of-July fatalities. In recent years, through the prolific and reckless use of fireworks, it has come to such a pass that the fire departments in all American cities are kept on the jump from morning until long after midnight. This of course entails a loss of money, for every time a fire engine is called out means just so much in dollars and cents to the city. When boiled down to hard figures the total and combined cost of Fourth-of-July folly to all of the cities in the Union would be a startlingly large sum.

Medical statistics show a great number of cases treated in clinics or consigned to wards in hospitals as a result of Fourth-of-July accidents. More cost to the city. Then to top off everything else and to provide a fitting climax for the "glorious Fourth" cities spend thousands of dollars for night fireworks. The New York City fathers this year spent $31,000. For half of that sum it is probable that every park in New York could be beautifully illuminated for two nights in the same manner as City Hall Park was lighted with electric lamps in Japanese lanterns.

In order to show what could be done along this line and in furtherance of Mayor Gaynor's safe and sane Fourth-of-July movement, the New York Edison Company volunteered to illuminate the City Hall and Park, bearing the entire expense, even the cost of current. Two bands of eight-candlepower incandescent lamps encircled the entire building, one at the top and one at the lower ledge. These lights were alternately blue and white, the city colors, and were spaced a foot apart. Gar-

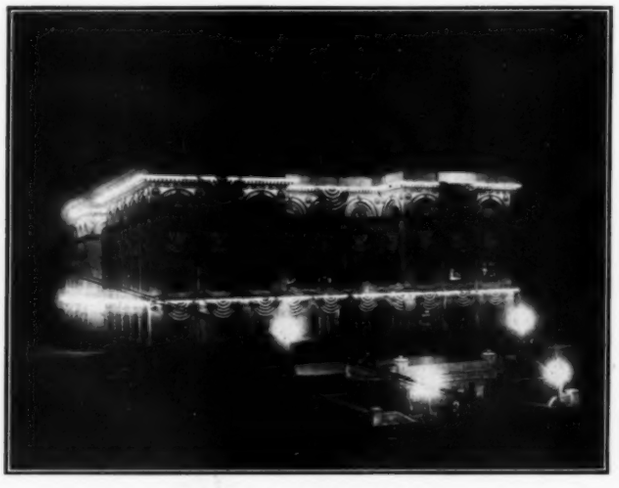
lands of light were festooned from tree to tree throughout the City Hall Park, creating a most pleasing garden effect. At night the "Stars and Stripes," and the state and city flags floated from the Hall while several search lights played on them continuously.

To the thinking observer there was a strikingly obvious comparison between this charming illumination which lasted the whole evening and the momentary flashes of roman candles and sky-rockets which represented the burning of part of the city's $31,000. Here was a permanent form of beauty which attracted the eye and pleased as long as one cared to look at it, while on the other hand the costly fireworks were but a transitory gleam of colors in the sky accompanied by a few explosions.



YONKERS CITY HALL.

NEW YORK CITY HALL.



BRONX BOROUGH HALL.

Seasoning Wood by Electricity.

The following item from a British technical paper concerns a new process of seasoning wood by electricity in France:

A large tank is filled with a solution containing ten per cent of borax and five per cent of resin, with just a trace of carbonate of soda. In the bottom of the tank is a lead plate which is electrically connected to the positive pole of the dynamo. The timber to be treated is stacked on this plate, and when the tank has been filled another plate is superimposed and connected to the negative pole of the dynamo. When the current is switched on it passes through the stack of wood between the two plates, and in its passage it is said to drive out the sap in the timber and deposit borax and resin its place, completely filling up all pores and interstices. When the process is completed the timber is removed and dried, after which it is ready for use.

With the appointment of William D. Terrell as wireless inspector of the Department of Commerce and Labor, the records of steam-ships carrying wireless equipment are to be thoroughly inspected. There will be inspectors for the Pacific coast, Porto Rico and Hawaii.

Phonographic Device for Reproducing Telephone Messages.

Although the idea of a phonographic receiver for a telephone is not exactly new, an impetus has lately been given it by research work which has just been done by three members of the French Academy of Sciences. According to the latest scheme an air chamber is left between the diaphragm of the telephone and that of the phonographic microphone. With a starting device actuated by the operation of the calling mechanism the message would be recorded in the subscriber's absence and retransmitted upon his return. Such a device would considerably enhance the value of the telephone and would not complicate it unnecessarily.

Cost of Car Lighting.

The experience of French railway companies with different types of car lighting has recently been made public. The lamp-hour is taken as the unit of comparison, although the electric lamps give twenty-five candlepower, the gas lamps twenty candlepower and the oil lamps seven candlepower. The cost of oil is taken as 15 cents per kilogram, of gas $1.00 to $1.25 per thousand cubic feet, and of electric power as 0.9 cent per kilowatt-hour. A comparison is given in an accompanying table indicating that electric lighting is the cheapest, while giving the most light. Oil is most expensive.

TELEPHONY—TELEGRAPHY, and WIRELESS.

Marconi's Lecture on Radiotelegraphy.

An intensely interesting lecture touching on the past, present and future of radiotelegraphy was delivered before the Royal Institution in London, Eng., on June 2 by Guglielmo Marconi. For the following abstract we are indebted to the *Electrical Engineer*.

Mr. Marconi dealt at some length with recent developments, with the experiments undertaken with a view to the prolongation of waves, methods of securing persistency of oscillations, the employment of direct current, and other questions of the first importance.

Referring to the tests carried out in September and October of last year between Clifden and Glace Bay and the Italian steamer *Principessa Mafalda*, he said the receiving wire was supported at a height varying from 1,000 to 3,000 feet by a kite, and signals and messages were obtained without difficulty by day as well as by night up to a distance of 4,000 miles from Clifden. Beyond that distance signals could be carried only by night. At Buenos Aires, more than 6,000 miles from Clifden, the night signals from both Clifden and Glace Bay were good, though their strength varied, but they could not be detected in the day time though in Canada the signals from Clifden (2,400 miles) were no stronger during the night than by day. The arrangement at Clifden which had given the best results was based upon the syntonic system of 1900, in which numerous improvements had been made since that date. An important innovation was the adoption there and at Glace Bay of air condensers composed of insulated metallic plates suspended in air at ordinary pressure. These greatly reduced the loss of energy which would take place in consequence of dielectric hysteresis were a glass or solid dielectric employed.

With regard to the experiments for obtaining continuous or prolonged trains of waves, the lecturer said it had been his experience that, when utilizing the best receivers at present in use, it was neither economical nor efficient to attempt to make the waves too continuous. Much better results were obtained when groups of waves were emitted at regular intervals in such manner that their cumulative effect produced a clear musical note in the receiver, which was tuned not only to the periodicity of the electric waves transmitted, but also to their group frequency. In this manner the receiver might be doubly tuned, with a result that a far greater selectivity could be obtained than by the employment of wave tuning alone. Results almost as good as those obtainable by means of continuous oscillations could be achieved with groups of waves, the decrement of which was in each group 0.03 or 0.04. This meant that thirty or forty useful oscillations were radiated before their amplitude had become too small to affect the receiver perceptibly. The condenser circuit at Clifden had a decrement of from 0.015 to 0.03 for fairly long waves.

This persistency of oscillations had been obtained by the employment of his system of 1907 in which the apparatus consisted of a metal disk having metal studs firmly fixed at regular intervals in its periphery and placed transversely to its plane. This disk was caused to rotate very rapidly between two other disks by means of an electric motor or steam turbine and the side disks were also made to revolve in a plane at right angles to that of the middle disk. The studs were of such a length as just to touch the side disks in passing and thereby bridge the gap between the latter.

The effect of this instrument was that with the frequency employed at Clifden (45,000), when a potential of 15,000 volts was used on the condenser, the spark gap was practically short-circuited during the time in which one complete oscillation only was taking place, when the peripheral speed of the disk was about 600 feet a second. Thus the primary circuit could continue oscillating without material loss being caused by resistance in the spark gap. The number of oscillations was governed by the thickness of the side disks, the primary circuit being abruptly opened as soon as the studs attached to the middle disk left the side disks, and this sudden opening of the primary circuit tended immediately to quench any oscillations which might still persist in the condenser circuit, a circumstance which embraced an important advantage for, if the coupling of the condenser circuit to the aerial was of suitable value, the energy of the primary would be practically all passed to the aerial circuit during the period of time in which the primary condenser circuit was closed by the stud filling the gap between the side disks, but after this the opening of the gap at the disk prevented the energy from returning to the condenser circuit from the aerial.

The regular employment of high-tension direct current for charging the condenser was another important feature at Clifden. Continuous current at a potential which was capable of being raised to 20,000 volts was obtained by means of special direct-current generators which charged a storage battery of 6,000 cells connected in series. The capacity of each cell was forty ampere hours. When the cells were employed alone the working voltage was from 11,000 to 12,000 volts, and when both the direct-connected generators and the battery were used together the potential might be raised to 15,000 volts through utilizing the charging voltage of the storage cells. For a considerable portion of the day the storage battery alone was employed, with the result that for sixteen hours out of the twenty-four no running machinery need be used for operating the station with the exception of the small motor revolving the disk. The potential to which the condenser was charged reached 18,000 volts when that of the battery or generators was 12,000, this being brought about by the rise of potential at the condenser plates, following the rush of

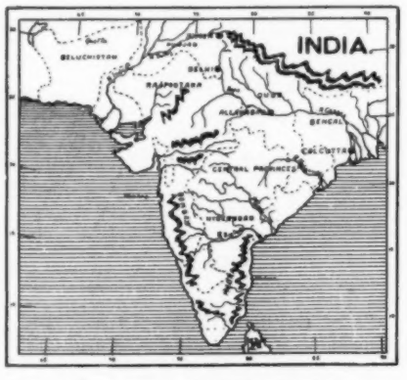
current through the choking coils at each charge.

Mr. Marconi said that a curious result first noticed nine years ago in long distance tests carried out on the *Philadelphia* was the detrimental effect produced by daylight on the propagation of electric waves over great distances. According to Professor Fleming, the daylight effect should be more marked on long waves than on short, but the reverse had been his experience, and in some trans-Atlantic experiments in which waves about 8,000 meters long were used, the energy received by day at the distant receiving station was greater than that obtained at night. Later observation tended to show that the effects varied greatly with the direction of transmission, the results obtained when transmitting in a northerly and southerly direction being often altogether different from those observed in the easterly and westerly direction. Observations showed that while the strength of the received waves remained as a rule steady during day time, they become gradually weaker after sunset, and about two hours later they were at their weakest. They then began to strengthen again, and reached a very high maximum at about the time of sunset at Glace Bay.

There was no doubt that wireless telegraphy was tending to revolutionize our means of communication. In the twelve months from May, 1910, to last April, commercial messages containing a total of 812,200 words were sent and received between Clifden and Glace Bay, while the fact that a system of imperial wireless telegraphy was to be discussed at the Imperial Conference showed the supremely important position which radiotelegraphy over long distances had assumed in the short space of one decade. Its importance from a commercial, naval and military point of view had increased very greatly during the last few years as a consequence of the innumerable stations which had been erected or were in course of construction. Notwithstanding this multiplicity of stations and their almost constant operation, mutual interference between properly equipped and efficiently tuned instruments had been almost entirely absent. Some interference did, without doubt, take place between ships, because the two wave-lengths adopted in accordance with the rules laid down by the International Convention were not sufficient for the proper handling of the very large number of messages transmitted, and a considerable advantage would be obtained by the utilization of a third and longer wave to be employed exclusively for communication over long distances. In regard to the high-power trans-Atlantic stations, the facility with which interference had been prevented had to some extent exceeded his expectations. At a receiving station situated at a distance of only eight miles from the powerful sender at Clifden, during a recent demonstration arranged for the Admiralty, messages could be received from Glace Bay without any interference from Clifden when this latter station was transmitting at full power on a wave-length differing only twenty-five per cent from the wave radiated from Glace Bay.

Wireless Stations in Hindustan.

For some years past the Indian Government has been considering the question of erecting a network of wireless telegraph stations in order to link up the principal towns and military garri-



MAP SHOWING MARCONI STATIONS IN HINDUSTAN.

sons of the vast area which is under its control.

The first active development of this scheme took place in the beginning of this year when the Marconi Wireless Telegraph Company, Limited, received an order from the Indian Government for the erection of four stations for the purpose of connecting Simla, Delhi, Allahabad and Calcutta. Wireless telegraphy is likely to play an important part on the northwest frontier, from the strategical point of view, by offering a rapid and reliable means of communication between the long chain of outposts extending from Quetta to Peshawur, where at present considerable difficulties exist in maintaining any system of land-line communication, owing to the extremely mountainous nature of the country and the unruly character of the inhabitants of the region crossed.

The work of erection of the first four stations above mentioned is being actively carried out.

The first station is being erected at Bimla, the famous summer resort of the Viceroy, and seat of the Government situated a few miles south of the River Sutlej, on a spur of the Himalayas, at an elevation of about seven thousand feet above sea level.

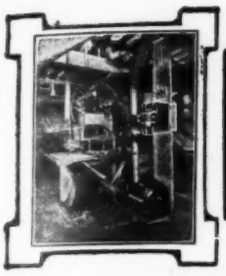
The Simla station consists of a standard five-kilowatt installation, and will be furnished with two directional type aerials 1,000 feet in length, and one short receiving aerial of 320 feet in length. The antenna will be supported by three masts of the sectional steel type, the mainmast being 260 feet in height, with two extension masts of 110 feet above ground level. Power will be supplied by a slow-speed oil engine, which has been specially selected for work at high altitudes.

The Simla station will connect direct with the Delhi station, and from thence to Allahabad, and finally to the station at Calcutta.

The wireless station at Delhi is to be of a more powerful character than that at Simla, and is being furnished with thirty-kilowatt apparatus. The antenna will be of the directional type, consisting of two inverted L-shaped aerials, each 800 feet in length, together with one receiving aerial for short waves. The whole aerial system is to be supported by six sectional steel masts, 260 feet in height, while the necessary power supply will be obtained from the local mains.

At Allahabad, the capital of the United Provinces of Agra and Oudh, situated at the junction of the Ganges and Jumna, and at Calcutta, the capital of British India and the official seat of the Government, two thirty-kilowatt stations are to be erected, one at each place, and similar in all respects to the Delhi installation, with the one exception, however, that in both the latter cases the stations will be self-contained, the power being supplied from a slow-speed horizontal-type oil engine.

All the four stations above mentioned will be furnished with their own batteries of accumulators, whilst the receiving apparatus is of the very latest type, comprising the well known oscillation-valve receiver.

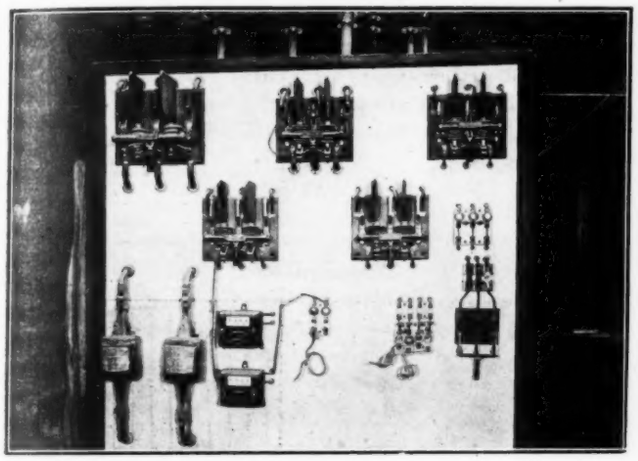


Industrial Power

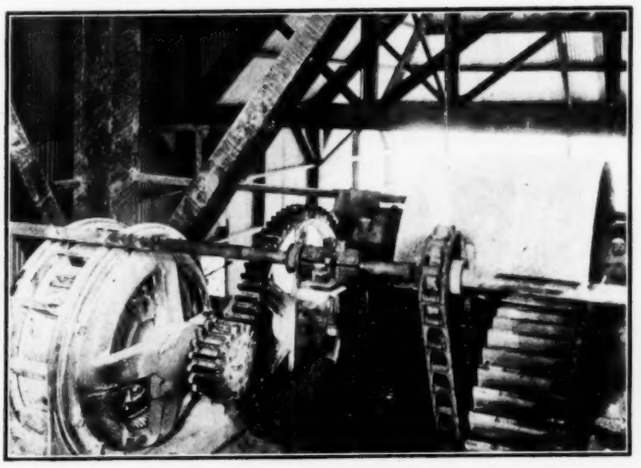
Stockton Fire Enamel Brick Plant.

The plant of the Stockton Fire Enamel Brick Company, which makes a specialty of glazed and malt-glazed bricks, is located on the outskirts of Stockton on the Southern Pacific and Western Pacific Railroads. Two spur tracks, about 1,000 feet long, run from the Southern Pacific line to the works, the raw material being brought in on one track, and the finished product sent out on the other.

The clay, which is the finest obtainable in California, is brought from Lincoln, Placer County, about seventy miles distant. It is dumped from the cars and then shoveled into a dry pan, belt driven by a thirty-five-horsepower motor of the squirrel-cage type, where the clay is ground up fine and then drops through a screen in the bottom of the dry pan and is caught up by a cup elevator driven by a five-horsepower General Electric induction motor and carried to top of building and dropped onto a screen, through which it passes into a number of bins placed about twenty feet below. From these bins the ground clay is conducted through a pipe to the pug mill, where it is mixed with water and sand in such proportions as to give it the right consistency. The pug mill is driven by a twenty-five horsepower induction motor. From the pug mill the mixture passes by gravity down a chute into the brick machine on the ground floor. A seventy-five-horsepower induction motor drives the brick machine. The compressed clay is conveyed from the brick machine by a belt to an automatic cutting table where the clay is cut to the requisite size for bricks. These bricks are then conveyed to another department where they are dipped in the glazing solution, and then either taken to a drying room, or allowed to dry in the sun. After being dried they are again dipped in the glaz-

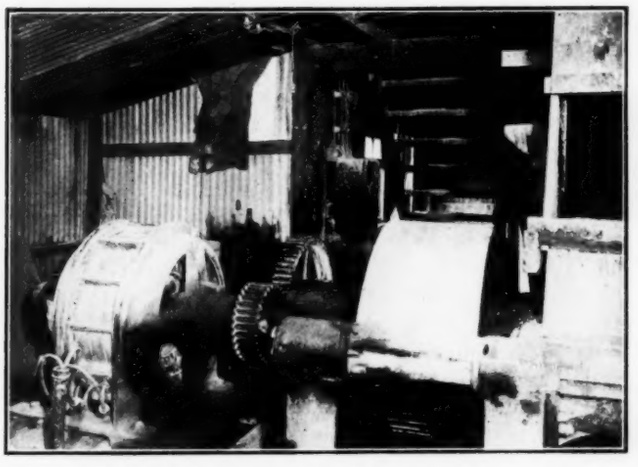


SWITCHBOARD.



MOTOR DRIVING PUG MILL.

MOTOR DRIVING DRYING PAN.



MOTOR DRIVING BRICK MACHINE.

ing solution, after which they are taken to the kiln to be burned. The bricks are then ready for shipment.

It is interesting to note that the bricks require only one burning, unlike other factories on the Coast, which have to give two burnings. The special glazing which this company uses, makes it necessary to burn the bricks but once. Each of the four kilns has a capacity of 60,000 bricks, and is heated by means of oil to a maximum temperature of about 2,000 degrees Fahrenheit.

Power is taken from the Pacific Gas & Electric Company at 2,200 volts, three-phase, sixty cycles, and transformed down to three-phase 440 volts by means of three twenty-kilowatt oil-cooled transformers. These transformers take care of the average load of sixty-horsepower easily.

The plant has been in operation for six years, and during that time the only repairs to the motors have been the replacement of new bearings and a few minor adjustments.

All of the electrical machinery is of General Electric manufacture, and the brick and clay machinery was made by the American Clay Machinery Company. The installation of the electrical apparatus was made by the Electrical Engineering & Supply Company, Stockton, Cal.

Meeting of American Society of Heating and Ventilating Engineers.

The semi-annual meeting of the American Society of Heating and Ventilating Engineers was held at the Hotel La Salle, Chicago, July 6, 7 and 8. Among the papers presented was one by Paul P. Bird, ex-smoke inspector of Chicago, entitled "Some Phases of Smoke Prevention." The data contained in this paper was taken from Mr. Bird's annual report, mention of which was made in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for April 8, 1911.

The greater portion of the meetings was devoted to informal discussions on miscellaneous subjects, there being only six papers scheduled for presentation.

Non-Corrosive Alloys.

Patents have been granted for a process for making a non-corrosive alloy consisting of 30 to 70 per cent iron, 25 to 50 per cent nickel and 5 to 20 per cent copper, which can be rolled into sheets or drawn into wire.

MOTORS FOR PRINTING-PRESS EQUIPMENT.

BY J. F. NISBET.

Direct-current motors for printing-press work should generally be compound wound. A shunt-wound motor which is required to start a heavy load, such as a printing press, will drop in speed and probably spark at the brushes, whereas, the addition of the compound winding will enable the motor to start the load without any difficulty, and with an entire absence of sparking.

A rather important question that often confronts a printer considering the installation of electric drive, is whether to install individual motors on each machine, or whether to drive with one large motor through shafts and countershafts.

The individual-motor system costs more in the first place, but is without any doubt cheaper in the long run, and is certainly a long way ahead of the single-motor equipment in regard to economy, convenience and service. A single motor must necessarily be large enough to drive all the machines which are required to operate at the same time. It is not often that such is the case, but the motor must be large enough to carry the load when it is found necessary to do so. This naturally means that for a greater part of the time when only a few machines are in operation, this motor will be running at considerably less than its rated output—in other words, underloaded.

A motor operating under these conditions suffers woefully in efficiency, and as a direct result the increase in the power bill will be proportionally great. It will be evident that a motor which is sometimes called upon to operate all the machines at one time, and at other times perhaps only one or two machines at a time, will often be operating at a fractional load. What this means it is impossible to say—certainly a loss of not less than twenty, thirty or perhaps forty per cent efficiency.

In addition to this, it must be remembered that from forty to fifty per cent of the available power is usually wasted in driving shafts and countershafts.

There is also the light obstruction, and the dust and dirt caused by moving belts. The annoyance of dripping oil from the line-shaft bearings, and the knowledge back of all that, should the motor break down, the whole shop will be out of commission.

Now what are the advantages of individual-motor drive? First of all, power is only used in proportion to the number of machines in use at any time. If only one machine is in operation, power sufficient only for driving this machine is required. The power required for driving shafts and countershafts is eliminated. There are no overhead moving belts to obstruct light or to create dust and dirt and there are no line-shaft bearings to drip oil over the finished work. If any motor breaks down, only one machine is put out of commission, and not the whole equipment, as is the case with the single-motor equipment. And finally, the aggregate horsepower required will be less than that required when only one motor is employed. These are overwhelming advantages in favor of individual drive, although what is perhaps the most important has not been mentioned.

The individual-motor equipment permits a controller to be placed on each press whereby the pressman can control the speed of the press at will. It means more and better work in a shorter time. It saves money for the printer and reduces waste in just that place where waste is most continual.

The proper selection of a motor for driving any printing press is a matter which requires careful consideration. Any motor at any speed will not do. In order to obtain maximum efficiency the motor should be exactly the right size, the speed should be chosen with due regard to the operating conditions of the press, and the control should be such that the press can be operated at its maximum or minimum speed with the greatest efficiency.

This is properly the work of a motor-manufacturing company experienced in the application of motors to printing presses and should never be undertaken by any person whose qualifications as an electrician do not include a detailed knowledge of printing-press requirements.

At the present time there is a controversy in progress regarding the lack of an adequate cost system in many printing establishments. It is agreed that many printers are daily losing money by taking jobs at less than cost price, simply because they are not in position to know what the actual cost of production is. In addition to this, many printers are daily losing money

on their electrical equipment and do not know it. Possibly nine out of ten do not realize that a motor too large for its purpose costs more to run than one of the right size would do. It has probably never been brought to their notice that lost efficiency in a motor means a corresponding increased per cent in their power bills.

For example, a five-horsepower motor operating at full load has an efficiency of approximately eighty-eight per cent. At three-quarter load the efficiency would only be eighty-six per cent; at half load it drops to seventy-nine per cent. What does this mean to a printer in dollars and cents? It means a loss of two cents on the dollar in the first case, or seven cents on the dollar, in the latter case. This is on one motor only. If there are many motors underloaded in this way the loss would be correspondingly greater. Many printers whose electrical equipment is in good order will possibly consider this supposition overdrawn. The writer, however, knows of one printer who operated a 10 by 15 jobber with a one-horsepower motor, whereas a one-quarter-horsepower motor would have been of ample size; this man was actually losing seventeen cents on the dollar and did not know it. There are without doubt many printers who have installed motors too large for the intended duty, and are, therefore, losing money in a greater or less degree. The reason for this is not far too seek.

An inexperienced man or one not fully familiar with printing-press requirements will invariably recommend a motor that is too large rather than one that is too small. He knows that a motor too small for the intended duty will give trouble from the outset, whereas, one that is too large will only betray the fact by the amount of current it consumes. He will, therefore, always make a conservative guess. This certainly emphasizes the need of obtaining expert advice—as the printer is called upon to pay the bills, which increase in almost direct proportion to the size of the motor.

A motor develops its greatest efficiency when operating at or about full load. Great care should therefore be taken to choose a motor which will operate at approximately full-load rating when the press is operating at its maximum speed. It may be asked, how can a printer determine what size motor to install? Is there any rule to determine what size motor to install for any given press? As far as the writer knows, there is not.

The majority of press manufacturers know what horsepower is required to drive their various sized presses, and several motor manufacturers have full data on this subject in their files. The above tables give the correct size motor for driving the presses mentioned. These tables have been compiled for direct current only, and while the size of motor will be approximately correct for alternating-current service—yet the speeds given will vary considerably, and should not be taken as applying to alternating-current motors.

These tables hardly need any explanation. The size of the motor pulley has been calculated so as to give the most desirable speed of press. Any reasonable speed, however, can be obtained by simply changing the pulley on the motor or in some cases the pulley on the press.

MOTOR RECOMMENDATIONS FOR MIEHLE PRESSES.

Press No.	Impressions Per Hour. Min.	Norm.	Max.	Press Pulley. Diam.	Face.	H. P.	R. P. M.	Motor Pulley. Diam.	Face.
00000	850	1415	1700	24″	6″	5	925	7¾″	6″
0000	850	1415	1700	24″	6″	5	925	7¾″	6″
00	730	1500	1800	24″	6″	3½	965	7½″	6″
1	900	1580	1900	24″	6″	3½	965	8″	6″
2	1000	1665	2000	24″	6″	3½	965	9″	6″
3	1000	1750	2100	24″	6″	3	1500	5½″	6″
4	1125	1830	2200	24″	6″	3	1500	5¾″	6″
5	1285	1910	2298	24″	6″	2	1025	5½″	6″
Pony 1	996	1845	2700	12″	5″	1½	750	4″	5″

MOTOR RECOMMENDATIONS FOR CHANDLER & PRICE JOB PRESSES.

Press.	Size.	Max. Imp. Per Hour.	Fly Wheel Diam.	Face.	R. P. M.	H. P.	R. P. M.	Motor Pulley. Diam.	Face.
Eighth Medium....	7x11	2800	31⅞	2	187	¼	1800	3¼	1¼
Eighth Medium....	8x12	2600	33⅜	2	173	¼	1800	3¼	1¼
Quarto Medium....	10x15	2300	40¼	2¼	230	¼	1800	5	1¼
Large Quarto.....	12x18	1800	42⅛	2¼	210	½	1200	7½	3
Half Medium.....	14x20	1500	42⅛	2¼	200	½	1200	7	3
Half Medium.....	14½x22	1500	42⅛	2¼	200	½	1200	7	3

MOTOR RECOMMENDATIONS FOR COTTRELL PRESSES.

Press.	Name.	Size.	Revs. Per Min. Min.	Nor.	Max.	Press Pulley.	H.P.	R.P.M.	Motor Pulley. Dia.	Face.
3	4 Roller—2 Rev.	27 x39	128	198	245	28x5	3	1500	4	5
5	4 Roller—2 Rev.	33½x46	147	220	267	28x5	3	1500	4	5
6	4 Roller—2 Rev.	33½x50	147	220	267	28x5	3½	965	6½	5
8	4 Roller—2 Rev.	39 x55	150	240	278	28x5	3½	965	6½	5
9	4 Roller—2 Rev.	43 x56	160	250	296	28x5½	5	1350	5¼	5½
10	4 Roller—2 Rev.	43 x62	160	250	288	28x5½	5	1350	5¼	5½
12	4 Roller—2 Rev.	47 x65	136	233	260	28x5½	5	1350	5	5½
13	3 Roller—2 Rev.	50 x74	136	212	265	28x5½	5	1350	4½	5½
5	Flat Bed Perf.	33⅞x45	87	146	170	28x6	5	925	5	6
8	Flat Bed Perf.	39¾x54	76	137	148	28x7	7½	550	7	9
9	Flat Bed Perf.	43 x62	80	137	154	28x7	7½	550	7	9
10	Flat Bed Perf.	44¾x63	76	123	146	28x8	7½	550	7	9
3	Monarch		100	125	150	24x4	1½	750	4	4
5	Monarch		100	125	150	26x4	1½	750	4¼	4
3	Triumph		100	125	150	24x4	1½	750	4	4
5	Triumph		100	125	150	24x4	1½	750	4	4
5	Paragon		100	125	150	26x4	1½	750	4¼	4
6	Paragon		100	125	150	26x4	2½	675	5	5½
8	Paragon		85	110	130	28x5	5	375	8¼	5

MOTOR RECOMMENDATIONS FOR HARRIS AUTOMATIC PRESSES.

Press.	R. P. M.	Press Pulley. Diam.	Face.	H. P.	R. P. M.	Motor Pulley. Diam.	Face.
EI	600	10	3	½	1200	5	3
EI, with sheet feed	600	10	3	1	1100	5½	3
EI, 2 color	600	10	3	¾	1800	3¼	3
EI, 2 color sheet feed	600	10	3	1½	1750	3½	3
SIF	600	10	3	1½	1750	3½	3
SIF, 2 color	600	10	4	3	1500	4	4
S-4	788	8	4½	5	1350	4¾	4
S-4, 2 color	788	8	4½	7½	835	7½	6½

MOTOR RECOMMENDATIONS FOR GOLDING JOB PRESSES.

Press.	Size.	Speed Max.	Nor.	Min.	Press Pulley.	Shaft Revs.	H. P.	R. P. M.	Motor Pulley Diam.	Face.
6	8x12	2800	2100	1400	20	143	¼	1800	1⅝	2
7	10x15	2300	1750	1200	16	148	½	1200	2	3
8	12x18	1800	1400	1000	24	161	½	1200	3¼	3
9	15x21	1500	1150	800	18	135	1	515	4¾	4
18	12x18	1800	1400	1000	18	144	1	1100	2½	3
21	15x21	1500	1150	1000	18	147.5	1	1100	2½	3

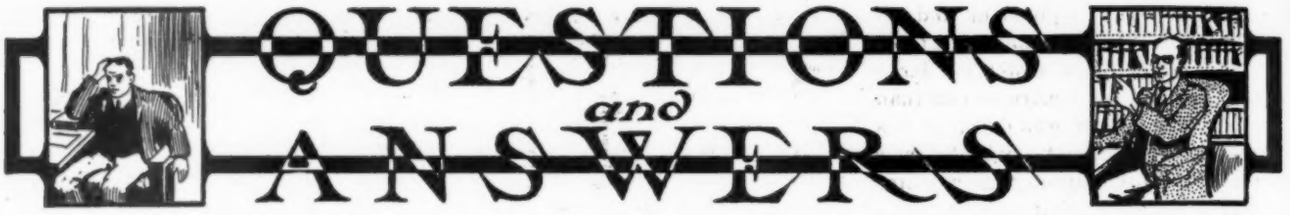
MOTOR RECOMMENDATIONS FOR GALLEY UNIVERSAL PRESSES.

Press.	Size.	Speed. Max.	Min.	Press Pulley.	Shaft Speed.	H. P.	R. P. M.	Motor Pulley. Diam.	Face.
1	10x15	2600	1400	12	263	½	1200	2⅝	3
3	10x15	2600	1400	18	271	¾	1800	2¾	3
1	13x19	1800	1000	18	271	¾	1800	2¾	3
1	14x22	1700	900	16	225	1½	750	4¾	4
3	14x22	1700	900	18	253	1½	1750	2½	3

Duty on Carbon Electrodes Shipped to Canada.

An analysis of the Canadian imports and the effect which would be produced by the pending reciprocity agreement shows some interesting figures in this line covering the past year. During the fiscal year ended March 31, 1911, Canada imported from us 3,649,000 carbon electrodes, of which the value was $36,719. The duty, amounting to $12,851.65, would be entirely remitted under the pending agreement.

No duty was collected on 1,111,669 carbons over six inches in circumference, and valued at $196,023, and these would still remain on the free list.



All readers of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN are invited to submit questions and answers to this department. Correspondents are requested to send full name and address. This, however, will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered.

Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office not later than ten days after the date of publication of the question. Answers will be published in a subsequent issue.

QUESTIONS.

No. 1.—LAMP-COLORING FLUIDS.—Please tell me the formulas for the fluids used in coloring incandescent-lamp bulbs red, green, orange, blue, etc.—W. B. L., Wallingford, Conn.

No. 3.—ROTATION NEAR ALTERNATING-CURRENT MAGNETS.—When two metal disks, mounted on pivots so that they overlap and are free to turn, are held over the pole of a magnet excited by alternating current, the disks rotate in opposite directions. Will you explain why this rotation takes place, and why one disk is affected differently from the other?—H. C., Evanston, Ill.

No. 4.—CHANGING GASOLINE CAR TO ELECTRIC.—Please tell me whether it would be practicable to change a single-cylinder runabout to an electric. The engine is claimed to be ten horsepower and is very noisy. The running gear and body of the car are in good condition; the chain drive could probably be used again. There is ample room under the seat for the battery. What size battery and motor would be required for a rig of this kind? What would be the cost of each and of a controller? We have a little shop and could make the change-over, if the electrical parts did not cost too much.—W. R. S., Ellsworth, Kans.

No. 6.—VERTICAL AND HORIZONTAL TURBINES.—What are the relative advantages of vertical as against horizontal steam turbines for driving generators? Why are the vertical machines not made in small sizes?—R. B., Milwaukee, Wis.

No. 10.—ELECTROMAGNET DESIGN.—What is the smallest sectional area of core of an electromagnet which will be sufficient to exercise a force of one pound upon an armature two inches away, and what winding should be used? It is to be connected to a 110-volt circuit and used intermittently.—M. E. R., Baltimore, Md.

No. 11.—TUNGSTEN AND ARC LAMPS IN SERIES.—Is it possible to install tungsten lamps on series circuits on which are lamps are also being used? What precautions are necessary?—W. M., Sheboygan, Wis.

ANSWERS.

No. 2.—COUPLING OF WIRELESS CIRCUITS.—In reading a paper on wireless telephony I ran across the terms "loose coupling" and "direct coupling," but could not make out from the text what was meant by them. Kindly explain the use of these words.—W. W. G., Chicago.

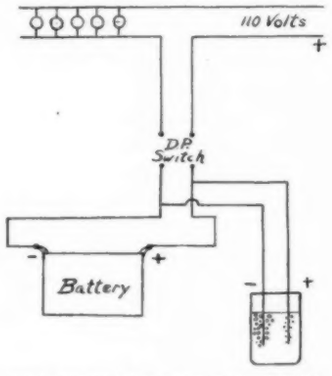
Two circuits are said to be coupled when their relative positions are such that some of the magnetic flux produced by a current in one is inclosed by the other circuit. In other words the two circuits have mutual inductance. The coupling is said to be loose when the mutual inductance is low, and the coupling is close or direct when the mutual inductance is high. The degree of coupling is regulated by the number of turns of a coil in one circuit wound upon the same core, as the turns in the other circuit.—R. M., Oak Park, Ill.

No. 5.—PAPER INSULATION FOR TELEPHONE CABLES.—Why is paper used to insulate wires in most telephone cables? If water enters the cable through a puncture in the sheath, does it not spread to and ground more wires than if some other insulation were used?—M. L. S., Cairo, Ill.

In telephone cables it is very desirable to keep the capacity as low as possible. Since the specific inductive capacity of air is as low as any other material which can be used as an insulator, this is the most desirable substance for the purpose. Crumpled paper is used in the telephone cables because it occupies but a small part of the total insulating space, the rest being filled by air. It is true that such cable is more liable to damage by water, but as a puncture in the sheath is a very unusual occurrence this does not overcome the advantage of the air insulation.—D. L., Philadelphia.

No. 7.—CHARGING IGNITION BATTERIES.—Please explain how a sparking battery can be charged from the ordinary light wires in a house. The lamps are marked 110 volts and the battery 6 volts.—G. A. T., Chadron, Neb.

It is assumed that the questioner refers to a direct-current circuit. If so, I would suggest that he connect about five thirty-two-candlepower carbon 110-volt incandescent lamps in parallel and connect up the circuit as shown in diagram herewith, making sure that the positive wire is connected to the + terminal on the battery. The polarity of



CHARGING IGNITION BATTERIES.

the circuit can be determined by carefully inserting the ends of two wires connected to the circuit into some dilute sulphuric acid or electrolyte from the cells; the wire giving off the most bubbles should be connected to the negative lug on the battery. When fully charged the battery should gas freely and, if a voltmeter is connected across, it will read about 2.5 volts per cell or 7.5 volts across the three-cells while the charging current is on.—H. C. R., Grasselli, Ind.

No. 8.—ELECTRICIAN IN UNITED STATES NAVY.—Can an experienced wireman become an electrician in the United States Navy without enlisting for a definite number of years?—C. E. N., Fort Wayne, Ind.

No. Electricians in the United States

Navy are required to be regularly enlisted men. The term of enlistment is four years. Applicants for the regular course must be between eighteen and twenty-five years of age and must pass a physical and an electrical examination. If these tests are satisfactorily passed, the applicant is placed in the landsmen class and sent to one of the naval electrical schools, such as those at Brooklyn (N. Y.) and Mare Island (Cal.) Navy Yards. Here he is given a course of about six months in dynamo and motor tending, electrical repairing, wireless telegraphy, etc., as practiced in the naval service. When found proficient, he is admitted to the position of electrician, third class, with an increase of pay to $33 per month. Subsequent promotions lead to the position of chief electrician, which on permanent appointment brings $77 per month. An experienced electrician, who can pass the requisite examination and who is not over thirty-five years old, may be appointed directly as electrician, third class.—U. S. N., Chicago.

No. 9.—LIFE OF MERCURY-RECTIFIER BULBS.—What is the average life of the special glass bulbs used in mercury-arc rectifiers? Do any manufacturers guarantee them for a certain length of time?—H. S., Chicago.

The life of mercury-rectifier bulbs depends a great deal on the local conditions, such as the fluctuations of voltage and load, temperature control, care in starting and operating in general. In some installations the average life has been found to be 700 to 800 hours; in others, when more care was bestowed on them, the average life has been found to run 2,000 to nearly 2,500 hours. Individual cases have frequently been noted of bulbs running over 4,000 and even 5,000 hours. The less fluctuation there is of voltage, load and temperature, the longer will be the life of the bulb.

General Electric Business Good.

The Pittsfield, Mass., plants of the General Electric Company are operating upon a basis of approximately eighty per cent of capacity. This means that nearly 5,000 men are being employed. Full operation would give employment to about 6,000 men. The company at no time has run its plant in excess of ninety per cent of capacity, so that present operations are regarded as satisfactory. The output at present is about ten per cent in excess of a year ago.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

INTERBOROUGH RAPID TRANSIT.

The Interborough Rapid Transit Company reports earnings for the month of May and eleven months ended May 31, which compare as follows:

	1911.	1910.
May:		
Gross operating revenue..	$ 2,622,792	$ 2,571,717
Operating expenses	1,092,244	930,846
Net operating revenue..	1,530,548	1,640,870
Taxes	171,746	161,708
Operating income	1,358,802	1,479,163
Other income	32,128	29,333
Total income	1,390,930	1,508,495
Interest, rent, etc., includ.		
Manhattan guarantee...	906,776	882,148
Net corporation income.	484,154	626,348
Passengers carried	51,100,464	50,007,832
July 1 to May 31:		
Gross operating revenue..	$27,404,273	$26,666,568
Operating expenses	11,330,239	10,079,379
Net operating revenue..	16,074,034	16,587,189
Taxes	1,731,999	1,591,196
Operating income	14,342,035	14,995,992
Other income	309,834	379,059
Total income	14,651,869	15,375,052
Interest, rentals, etc, incl.		
Manhattan guarantee...	9,781,104	9,673,219
Net corporation income.	4,870,765	5,701,833
Dividends	2,362,500	2,362,500
Surplus	2,508,265	3,339,333
Passengers carried	532,292,093	517,856,049

The footnote appended by the Interborough Rapid Transit Company to its statement of earnings for eleven months explains an increase in operating expenses of $1,250,859 as due largely to extraordinary expenditures, the results of change of subway equipment made necessary in connection with operation of the ten-car express and six-car local trains.

LONDON UNDERGROUND.

The associated companies of the Underground Electric Railways Company of London report for the month of May, 1911, as follows:

	1911.	1910.
Metropolitan District Railway:		
Gross receipts	£62,270	£59,583
Working expenses	28,639	27,066
Net receipts	33,631	32,517
London Electric Railway Company:		
Gross receipts	£64,703	£63,035
Working expenses	32,670	31,292
Net receipts	32,033	31,743
London United Tramways, Ltd.:		
Gross receipts	£31,229	£32,656
Working expenses	18,338	20,228
Net receipts	12,891	21,428

ONTARIO POWER.

The Ontario Power Company of Niagara Falls and the Ontario Transmission Company, Ltd., report to the New York Stock Exchange for the year ended Dec. 31, 1910, as follows:

Gross earnings	$721,901
Operating expenses	136,100
Net earnings	585,801
Other receipts	69,612
Total net income	655,413
Interest charges	567,900
Surplus for year	87,513

The consolidated income account of these companies for the quarter ended March 31, 1911, is as follows:

Gross earnings	$206,078
Operating expenses	35,053
Net earnings	171,025
Other receipts	22,870
Total net income	193,895
Interest charges	161,355
Surplus	32,540

CUMBERLAND TELEPHONE COMPANY.

The report of the Cumberland Telephone & Telegraph Company for the month of May and five months ended May 31 compares as follows:

	1911.	1910.
May gross	$ 606,018	$ 570,195
Expenses	367,170	322,540
May net	238,848	247,655
Charges, taxes, etc.....	50,310	47,717
May surplus	188,538	199,938
Eleven months gross.....	2,989,327	2,800,847
Expenses	1,770,980	1,596,636
Eleven months net.....	1,218,347	1,204,210
Charges, taxes, etc.....	256,992	239,311
Eleven months surplus.....	961,354	964,899

LAKE SHORE ELECTRIC.

The report of the Lake Shore Electric Railway system for the month of May and five months ended May 31, compares as follows:

	1911.	1910.
May gross earnings.....	$ 105,321	$ 100,424
Operating and taxes	54,429	52,983
Net	50,892	47,441
Interest	34,584	35,035
May surplus	16,308	12,405
Five months' gross earnings.	444,635	423,194
Operating and taxes.....	254,947	246,453
Net	189,689	176,741
Interest	173,398	173,859
Five months' surplus.....	16,291	2,882

NASHVILLE RAILWAY & LIGHT.

The report of the Nashville Railway & Light Company, for the month of May and five months ended May 31, 1911, compares as follows:

	1911.	1910.
May gross	$ 163,174	$ 148,694
Expenses and taxes.....	97,539	88,722
May net	65,635	59,972
Charges and preferred dividends	49,013	48,567
May surplus	16,622	11,405
Five months' gross.....	794,548	730,527
Expenses and taxes.....	469,989	425,013
Five months' net.....	324,559	305,514
Charges and preferred dividends	243,202	242,425
Five months' surplus.....	81,357	63,089

NORTHERN OHIO TRACTION.

The report of the Northern Ohio Traction & Light Company for the month of May and five months ended May 31, compares as follows:

	1911.	1910.
May gross	$228,693	$207,323
Expenses	124,656	111,250
May net	104,037	96,073
Charges	44,329	43,375
May surplus	59,708	52,698
Five months gross.....	977,579	865,662
Expenses	562,040	501,105
Five months net.....	415,538	364,557
Charges	221,774	216,541
Five months surplus	195,764	148,015

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of May and five months ended May 31, 1911, compares as follows:

	1911.	1910.
May gross	$ 658,739	$ 627,946
Expenses	311,974	289,382
May net	346,764	338,564
Charges, taxes, etc.....	140,079	140,112
May surplus	206,685	198,451
Five months' gross.....	3,100,449	2,931,643
Expenses	1,602,445	1,446,451
Five months' net.....	1,498,004	1,485,192
Charges, taxes, etc.....	700,396	701,029
Five months' surplus.....	797,608	784,163

Municipal Railway in Japan.

It is estimated that the cost, to the city of Tokio, of securing the Tokio tramways will be about 100,000,000 yen. or $50,000,000, and that the placing of a foreign loan for this will be necessary.

New Electrical and Mechanical Apparatus and Appliances.

New Electric Forge and High-Pressure Blowers.

The advantages of the electric forge blower over the hand blower or bellows need hardly be mentioned. It saves space as it is so small it can be put under the forge or any other place out of the way. It is started and stopped by a switch, which latter can be located wherever it will be handy to reach from the forge or anvil. The blast produced is strong and positive. The fire builds up quicker and better than with a bellows or hand blower. More can be done in the same time, as it requires no attention; while the iron is heating other work can be prepared or finished.

The latest development in electric forge blowers is an adaptation of the already famous "Sirocco" blower to that service. These blowers are made in three sizes, 6.5, 9.5 and 12.5 inches, respectively, the largest one being capable of caring for five fires.

FAN WHEEL.

Because of the high mechanical efficiency of the new "Sirocco" turbine type wheel, shown in one of the illustrations, the electric current consumption is so small as to be almost insignificant.

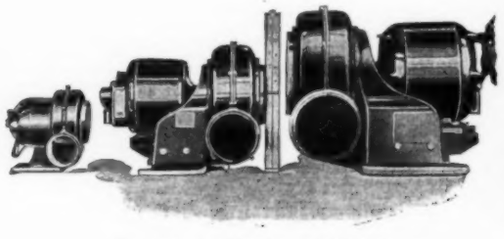
The smaller size, suitable for single light fire, uses less than half the current consumed by an ordinary electric lamp. The larger sizes are relatively of equal efficiency.

Comparing these blowers with a hand blower or bellows, it will be noted that there are no belts, no levers, no gears, no pulleys, no cranks, no springs. The "Sirocco" patented wheel being setscrewed to the motor shaft, there are only two bearings on the entire machine.

A few of the many advantages claimed for the "Sirocco" electric forge blowers are higher mechanical efficiency, hence smaller current consumption; quiet running; larger volume of air at ample pressure to overcome resistance of tuyere and fire; quicker and hotter fires because of perfect combustion of fuel in fire bed; smoother operation due to extremely small diameter of runner.

The American Blower Company, Detroit, Mich., manufacturer of this forge blower, is also placing on the market a new high-efficiency, high-pressure blower which has many commendable features.

The blowing of scale from dies can usually be accomplished with an air pressure of from 12 to 14 ounces per square inch, but in the motor-car industry, for example, where a large proportion of the work is on deep-cut dies a considerably higher pressure must of necessity be maintained.



THREE SIZES OF BLOWER.

The American Blower Company's recently developed special centrifugal pressure blower is admirably adapted for this service, as it is designed for pressures up to 24 ounces per square inch, and is still applicable for direct connection to standard-speed electric motors.

Such a scale blowing rig for deep die work has recently been installed by the Packard Motor Car Company, Detroit, Mich. The blower is an "ABC" special high-pressure machine, having a wheel eighty-two inches in diameter direct connected by means of a flexible strap coupling to a fifty horsepower direct-current motor. The motor operates at a trifle under full load with all the nozzles and deflecting pipes in service.

The blower maintains a pressure of twenty-two ounces over fifty-four 0.75-inch diameter scale-blowing nozzles shown to the left in the illustration and twenty-four deflecting pipes having an aggregate free area of thirty-four square inches. The velocity through these openings is 24,000 feet per minute.

In casting about for a machine suitable for this work, an air compressor might ordinarily be purchased, but the above described special high-efficiency blower will, the makers claim, effect a guaranteed saving in power and maintenance cost, as well as conserving the initial cost.

Blowers of this type are being successfully employed for furnishing blast to oil furnaces, such an installation being shown to the right in the illustration. They are also useful for forge and cupola service.

FORGE BLOWER INSTALLED.

Electric Sign Projector.

A new and very extensive medium for display advertising is coming into use as the result of the invention of the Electric Sign Projector. This medium gives the advertiser choice locations without limit, and not a cent to pay for rental. It is the sidewalk.

The electric sign projector is exceedingly simple in construction. Its essential features are a powerful little lamp, three lenses and a stencil containing the advertisement.

The lamp, which is a 100-candlepower of the glower type, operates on the regular 110-volt lighting circuit, either alternating or direct current.

The lenses, the glower and the stencil are located in a metal tube fourteen inches long and two and five-eighths inches in diameter.

The tube is separated at the end oc-

cupied by the lamp so as to provide for the insertion of a small globe, which makes the light available for illuminating the window in which the sign projector is placed. The pedestal for the tube to rest upon completes the outfit.

It can be placed on a bracket or attached directly to the ceiling, in the window, above the door, or in any convenient place. The tube may be adjusted to suit the position and height, being capable of adjustment to any angle. It is focused the same as an opera glass.

The advertisement, as it appears on the sidewalk, is not round, as shown on the stencil, but slightly elliptical. It varies from 3.5 feet longest diameter up, according to the distance of projector above the sidewalk.

While primarily intended for sidewalk advertising, the projector may be used for throwing advertisements on walls and ceilings as well. It has been effectively used by department stores as a wall sign, to call attention to special sales.

The Electric Sign Projector is manufactured by the Pittsburg Electric Specialties Company, 937 French Street, Pittsburg, Pa.

Electrical Development of Switzerland.

Practically every town, hamlet, and community in Switzerland is supplied with electric light and power, while all the street railways and many of the interurban and mountain roads are equipped with electricity. The abundance of water power accounts for much of this striking electrical development.

Cable Joints on Underground High-Tension Lines.

The Minerallac Electric Company, Chicago, Ill., has originated and perfected materials for use in high-tension underground cable joints which, the Company states, when properly used, render breakdowns and failures impossible. The materials necessary comprise (1) minerallac soft-finish bias linotape; (2) minerallac No. 1 semi-liquid; (3) minerallac No. 2 semi-solid; (4) three copper sleeves for connecting the cables; (5) lead sleeves for covering the joint.

In order to show the characteristics of this material a description of the most approved method of making cable joints on underground high-tension lines, using minerallac material, is given herewith.

FIG. 1—CONDITION OF CABLE AFTER SECOND OPERATION.

FIG. 2—COPPER SLEEVES INSTALLED.

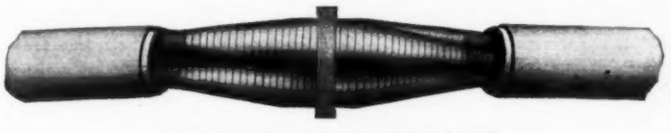


FIG. 3—JOINT WOUND WITH TAPE.

Saw off the two ends of the cable so that they will butt squarely together. Remove the lead sheath for eight inches from the end of each cable, and the outer paper insulation to within three-quarters of an inch of the lead. Cut back the paper insulation which is found upon each conductor approximately one and one-eighth inches from the end. Fig. 1 represents the condition of the cable after these two operations. Thoroughly clean and tin the copper of the conductors, always using soldering flux for this purpose. Slip the large lead sleeve, which is to be used in covering the completed joint, over one end of the cable and back far enough on the cable so as to be entirely out of the way.

Then insert the two ends of each conductor within the copper sleeves which are to be used as connectors, and solder them very thoroughly into their separate sleeves by pouring melted solder over the connections. This step is shown in Fig. 2.

Cut the paper insulation of each conductor three-eighths of an inch farther back from the copper sleeve in order to remove any material which might have been charred during the soldering. Starting one inch back from the end of this insulation, taper the paper down to the conductor as shown in the upper conductor of Fig. 2. Then wind the three-quarters inch linotape on the section of exposed cable until the diameter is built up to that of the copper sleeve. This wrapping must be applied in such a manner as to completely and tightly fill the space, and No. 1 Minerallac, slightly heated, should be very freely applied with a brush between the layers of wrapping in order to exclude all air. Thereupon apply the one and one-half inch linotape to the joint with Minerallac No. 1 as before, the turns overlapping two-thirds of the width of the tape. Continue this wrapping until the insulation around each conductor is built up to a thickness equal to that of the original paper insulation.

FIG. 4—COMPLETED JOINT.

Starting at a point on the insulated conductor three inches from the lead sleeve on one side of the joint, apply a layer of tape to within three inches of the sleeve at the other side of joint, each turn overlapping the one preceding by one-half the width of the tape. The following layers are to start and finish one-half an inch nearer the center of the joint than the preceding layer, the completed wrapping forming a cylindrical body of insulation at the center of the joint with conical ends tapering down to the original paper insulation. The total diameter of this completed cylindrical portion is determined entirely by the voltage of the cable: for example, approximately one and one-half inches for 10,000 volts.

After all three conductors are insulated as described, place a roll of tape, three-quarters of an inch in diameter, between the conductors to act as a spreader. Finally wind a narrow wrapping, built up to the inside diam-

eter of the lead sleeve, around all of the conductors in order to hold them together, and also to center them within the sleeve The joint will then appear as shown in Fig. 3.

Slip the lead sleeve into its proper position, and fasten the ends carefully to the two cables by "wiping." This must be done in a very workmanlike manner in order to insure an absolutely water-tight joint. Form a hole about three-quarters of an inch square on the top of the sleeve near each end by cutting on three sides and bending back the lead on the fourth side as a hinge. Heat a quantity of Minerallac No. 2 sufficient to completely fill the joint, to approximately 150 degrees centigrade, and pour it slowly into one hole until the joint is full. Leave it undisturbed for half an hour, thus allowing the Minerallac to cool and shrink. When cool, carefully level, and pour in hot Minerallac until it flows from both holes, showing that all voids have been properly filled. Replace the leaf of lead which was bent back to form the hole into its former position, and very carefully seal it by soldering.

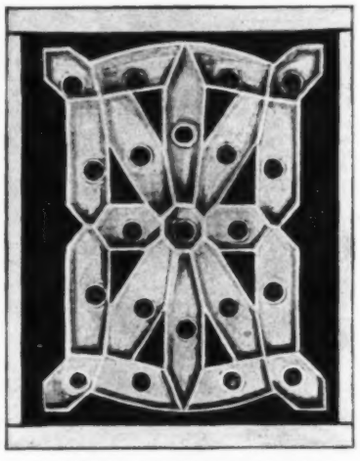
This series of operations completes a joint shown in Fig. 4, which is absolutely water-tight, and which, if properly done, will be as strong, mechanically and electrically, as any other portion of the cable.

The Talking Sign.

The constant and automatic succession of advertisements in an electric sign not only strongly attracts the attention of the public, but it arouses a lively and lasting interest in electrical advertising. This succession of advertisements in a single electric sign is accomplished in the "Talking Sign," manufactured by the Wall-Win Company, Jersey City, N. J.

The talking sign consists of any desired number of monograms or units in each of which any letter or figure can be formed by lighting certain combinations of incandescent lamps. These lamps are controlled by a simple mechanical arrangement operated by a small motor. Any reading matter can be flashed by properly setting the mechanism. Announcements can be changed in a few moments. It is made up on a unit system so designed that a sign with any number of monograms can be erected. The monograms are made in single units; that is, a unit consists of one monogram. The commutators or the flashers which control the changers are made in units of three sizes consisting respectively of one commutator, two commutators, and five commutators. This system enables a sign to be arranged to conform to the available space and it also allows additions to be made to the sign without disturbing the original installation.

The monogram, shown in the accompanying illustration, consists of a collection of metal compartments, each arranged to receive an incandescent lamp. These compartments are arranged to confine the light to a certain space, thus forming a clearly defined letter, which can be read from great distances. The average size monogram requires twenty-one lamps, but the maximum number of lamps burning at one time is nine



MONOGRAM OF "TALKING SIGN."

The commutators are operated by an electric motor of standard construction. The mechanism which revolves the commutators is driven by a belt from the motor and is so arranged that it brings into position the different sets of letter bars one after another and so shows each different announcement on the sign. After each change the letter bars remain in position for a few seconds to allow the announcement to be read. The length of this time can be regulated by changing the speed of the gearing.

Copper Exports for June.

Copper exports for June aggregated 67,365,760 pounds, the largest reported this year, and 5,387,203 pounds in excess of last month. The best previous month in exports this year was April, when 62,129,599 pounds were shipped abroad.

New Train-Dispatching Apparatus.

Since the development of the telephone for train dispatching, a need has been felt for signaling equipment which could be used and operated in connection with a telephone train wire. That is, instead of having a selector on a telephone circuit ring a bell at a way station, it was required that it should throw a semaphore arm. The Western Electric Company, in conjunction with the Union Switch & Signal Company, has for some time been developing apparatus to meet this particular need, and a description of the new apparatus and its uses is given here.

Both steam and electric railroads offer an extensive field of use for this selectively operated semaphore in connection with the telephone system. On steam roads it will probably be used exclusively for train-order work. In other words, it will be employed as an auxiliary to a regular telephone train-dispatching system. When used in this way it will secure a still further saving than is now effected by the telephone.

On the average railroad equipped for handling train movements by telephone, there are a number of offices along it which have to be kept open twenty-four hours a day and where three tricks of operators have to be employed for this purpose merely to take care of a small number of trains during the greater part of the day. Of course, during the busy hours it would be necessary to have an operator at the station, but at night, or during light-load periods, there were numerous cases where he could be dispensed with altogether, provided the dispatcher had some other means of reaching the trains.

The train-order semaphore meets this need exactly. It can be installed at any point desired along the right-of-way; the dispatcher can throw it at will, just as he can call a way station. He is informed absolutely as to whether the selector which he threw operated, and when the train is stopped by this means he he can get into direct touch with the train crew and give them their orders.

Since electric railways are now approaching steam railroad practice, the selectively operated semaphore will enter prominently the electric railway field. The application of the semaphore, selector and telephone equipment combined in one piece of apparatus for this class of service is obvi-

ous. Their use in this field cannot fail to facilitate the movement of trains and introduce many economies in the handling of traffic.

The semaphore can, in many places, be used as an auxiliary to the regular dispatching system, as it can be located at sidings or at points where the expense of a station and operators is not warranted. It thus forms a safeguard to the system that does not include the human factor.

The new Western Electric semaphore has some new features which are of particular interest. In Fig. 1 is shown

FIG. 1—OUTFIT COMPLETE.

the outfit complete. The semaphore proper is of standard make and can be furnished in either the upper or lower quadrant types, as desired. A three-spectacle casting is provided. The semaphore, selector and telephone equipment are all mounted on the same iron post, and the apparatus is self-contained. The weatherproof box is locked, so that access is obtainable to it only by means of keys which would be furnished to the proper parties. The semaphore blade itself can be furnished of any type or shape desired to conform to the practice of the railroad buying the equipment.

Everything is arranged for facilitating maintenance work. Ample size terminals are used throughout in the apparatus, and practically all maintenance connections inside the casting are made with terminal screws or hexagonal lock-nuts. The wiring throughout is of copper, insulated, weatherproof, braided wire, in conformance with good signal practice. All the telephone apparatus is water-proofed to withstand moisture. All wood used in the interior of the set is oil treated. The telephone and selector are inclosed in an inner compartment. All openings are arranged so that water cannot enter the set. In addition, the outer door of the set has a weatherproof gasket, rendering it practically impervious to moisture.

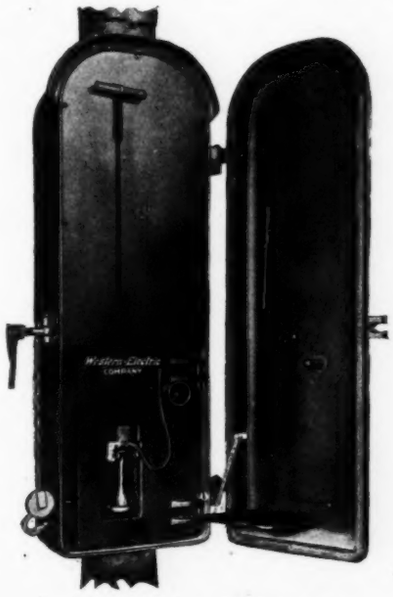


FIG. 2—SIGNAL MECHANISM.

Fig. 2 shows the pole casting containing signal mechanism, the telephone and selector equipment. The signal mechanism is of the electrically operated type, but is manually restored. The relay operating this is normally deenergized, and ten dry cells are required for its operation. As this relay will operate on four cells, it is obvious that an ample margin of operation is allowed.

The signal mechanism proper is contained in the compartment at the top of the casting. The only part of this which appears on the surface of the inside door is the handle of the restoring lever. The selector and terminals are readily accessible for maintenance purposes.

One important feature of the selectively operated semaphore is the fact that it gives to the dispatcher an answer-back which cannot be mistaken, telling him that one particular semaphore has completed its movement and is at the "Stop" position at the time the answer-back signal is received.

The telephone set is especially designed for railway work, and is of high efficiency. The transmitter and receiver are mounted on the outside of the inner door, on the lower part of the apparatus casting. The transmitter mouthpiece is of metal and so fastened in the set that it cannot be removed without opening the inner door. All parts are arranged so that they can be easily inspected and maintained, and they are of the usual "Bell" grade. All metal is given a black finish, which eliminates any chance of rusting.

The signal mechanism is operated by

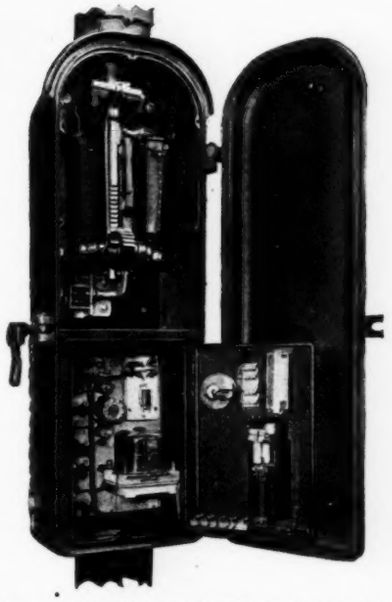


FIG. 3—APPARATUS CASE WITH COVER REMOVED.

the Western Electric's latest development in railway selectors. This selector is practically independent of weather conditions and absolutely reliable. It is in operation at the present time on eighteen of the largest railroad systems in this country, where it is giving universal satisfaction.

Fig. 3 shows the apparatus casting with the inside cover open. In this illustration will be seen the arrangement of the selector and terminal apparatus on the inside of the casting. The signal mechanism is shown above, together with the manually operated lever and the gears by means of which the semaphore blade is restored to the "Clear" position. The outside door of

the apparatus casting is provided with a sheet-iron writing shelf which will be a great convenience in taking down orders from the dispatcher.

The circuit arrangements of the signaling equipment above described are very similar to the standard train-dispatching circuit. The dispatcher operates selector keys in the same manner; instead, however, of a bell ringing at the point called, a semaphore blade moves to "Stop." The answer-back signal returns to the dispatcher clearly and distinctly and then it waits for the crew of the train so signaled to call in. Should he be disconnected from the circuit for any reason the crew can easily call him, but ordinarily operating practice does not require this. Only one pair of wires are needed to extend along the line. As many sets as may be desired can be connected to this circuit, and it is used both for talking and signaling. All equipment is bridged directly across the circuit, and any piece of apparatus can be taken off the line without affecting the rest of the equipment.

The use of these instruments, it is said, affords an exceedingly flexible system, for as many semaphores as can be located upon one telephone circuit as necessary, in addition to the telephone apparatus. If desired, standard telephone apparatus can also be used at other points along the circuit where semaphores are not located. This semaphore equipment can also be placed upon existing train wires which are being operated by means of the telephone. In addition to being exceedingly flexible, the use of these semaphores insures an accurate, speedy, convenient and economical method of handling train movements.

Fort Wayne Fire Department and Band.

The Fort Wayne Electric Works of General Electric Company, Fort Wayne, Ind., maintain a volunteer fire department of thirty men. This department is a member of the North-Eastern Indiana Volunteer Firemen's Association, which held its annual reunion on June 29 at Winchester. The department from the Fort Wayne Electric Works with the Electro-Technic Band, also from the same company, won first prize for appearance in the parade. Three men from the department won first prize in the water battle and the hose team won first prize in the hose-laying contest between eleven contestants.

The Electro-Technic Band in order to make a clean sweep of it won first prize that evening in the band contest from the best bands in the state.

Organizations of this character do much to increase "team spirit" at the Fort Wayne Electric Works, and an outing of this kind once in a while is greatly appreciated by both the Fire Department and the Band.

Battery-Charging Plugs and Receptacles.

A special charging plug and receptacle has been developed by the General Electric Company for use on commercial vehicles. Both the plug and

FIG. 1.—CHARGING PLUG.

receptacle are of unusually rugged construction and possess several peculiarly necessary and desirable features.

The plug, which is liable to rough usage, mechanically and electrically, through careless handling, is protected by an outside shell, which acts only as

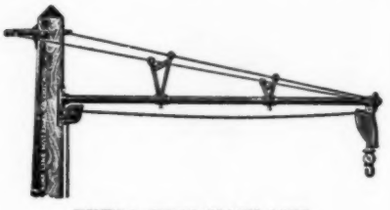
FIG. 2.—CHARGING-PLUG RECEPTACLE.

a casing for the insulating compound, thereby preventing short-circuiting if the plug is dropped on a metal floor, or brought in contact with any metallic object. The insulating compound is fireproof, and the charging leads can be permanently sweated in without melting the compound. Provision is made in the handle for tying a knot in the leads, before soldering, for the purpose of taking the strain off the joint in case the plug is accidentally pulled out by means of the cable. The plug is designed to be self-centering, thereby compelling its insertion in the receptacle properly. It has a normal capacity of 100 amperes, with fifty-percent overload for an indefinite length of time.

The receptacle is provided with a hinged cover, which effectually protects the internal parts from dirt and moisture. Under the pressure of a stout spring the cover automatically swings into position when the charging plug is pulled out. The action of the spring is positive and holds the cover firmly against its seat, thus preventing it from being jarred out of position by any shock or vibration due to the movement of the vehicle. The interior of the receptacle is covered with a coat of enamel to protect it from rust.

An Extra Firm Mast-Arm.

The supporting of individual transformers or regulating coils over each lamp and the use of flaming arc lamps



EXTRA FIRM MAST-ARM.

have both added considerably to the weight of the lamps and the consequent strains on the fixture supporting the same. To meet this demand, the Ajax Line Material Works, of South Milwaukee, is offering a mast-arm of unusual strength and rigidity. To secure this, the strain rods have been increased in size and two stiffening trusses instead of the usual single one add to the rigidity. Then the steel thrust arm from which the strain rods run to the outer end are anchored to the pole so that they cannot rock on the same, even if high winds tend to sway the fixture.

Of course the same distinctive features will also insure unusual firmness when used with lighter arc lamps, making this type particularly suited for use where lamps are to be hung at long reaches from the pole. It has therefore been called the Ajax "Jumbo" mast-arm and is offered either with a friction-stop lamp-supporting pulley or

with a cutout pulley which leaves the wires taut when the lamp is lowered for trimming.

How Steel Bins Aid in Fire Protection.

The matter of fire protection is of the utmost importance in every business, but it is a striking fact that thousands of merchants and manufacturers take no cognizance of the necessity of this protection. They are generally disposed to let well enough alone.

But progressive business men demand fireproof buildings because they want their property and their stock thoroughly protected.

An essential in this all-around fireproofing is the discarding of everything that is a fire contributor. One of the latest and newest products of this kind placed on the market for store, factory and warehouse fixtures is the steel bin, manufactured by the Berger Manufacturing Company, of Canton, O.

Steel bins are coming into favor for storing small stock of every description in bulk. Hardware dealers and other merchants are using them, while they are being introduced into many factories where it is essential that small parts be kept conveniently at hand.

One of the biggest manufacturing companies in the great Pittsburg industrial district long ago adopted a plan something like this, for the storage of valuable blue prints.

Telephone Train Dispatching.

The United States Electric Company, New York and Chicago, has received an order from the Bessemer & Lake Erie Railroad Company for thirty-six Gill selector equipments, bells to be rung by main-line battery; also the Gill calling keys and the telephone equipment necessary for the installation of the circuit. The same company is also furnishing for the Oregon-Washington Railway & Navigation Company twenty-five No. 502 Gill main-line selector outfits.

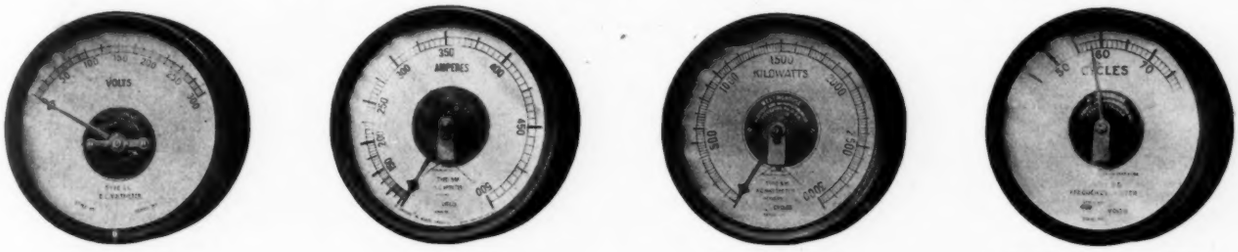
New Types of Switchboard Meters.

The increasing size of modern power developments and the growing capacity of available space, particularly in large cities, have emphasized the need of compactness in switchboard design. The desirability of having all the meters in plain view of one operator has long been appreciated, and this requirement necessitates meters that shall occupy a minimum of space and at the same time be easily readable from a distance. In many plants in congested districts the switchboard is located in a poorly lighted place, which imposes the further requirement that the meter dials be capable of thorough illumination. Accuracy and the possibility of making repairs quickly and easily on the premises are features that every power-plant manager requires.

In line with these strongly defined tendencies in switchboard design, the Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa., has developed a design of alternating-current and direct-current switchboard instruments, which, for their novel features, are of interest. The new meters comprise a complete line of seven-inch and nine-inch meters. The seven-inch alternating-current meters, known as type SM, and the nine inch, know as type TM, are built as ammeters, voltmeters, wattmeters, power-factor meters, frequency meters and synchroscopes. The corresponding types SL and TL direct-current meters are built as ammeters and voltmeters. The completeness of these lines makes it possible to design an entire switchboard with one uniform type of meter, either seven-inch or nine-inch throughout.

The scales of both sizes of alternating-current meters are 14.5 inches long. This remarkable scale length is as great as that found usually only in large illuminated-dial meters, and greater than that obtainable with edgewise meters that occupy as much room on the switchboard as these seven-inch meters do. The economy of space in comparison with the length of scale is shown in the following tabulation: Seven-inch type SM covers a rectangle fifty-five square inches; scale 14.5 inches long; nine-inch type TM covers a rectangle 107 square inches; scale 14.5 inches long; ordinary nine-inch meter round pattern, 107 square inches; scale 7.25 inches long; vertical edgewise meter covers 55 to 80 square inches; scale twelve inches long; horizontal edgewise meter covers fifty-two square inches; scale six inches long.

This long-scale feature is not depended on alone to make the meters easily readable. Instead of the usual metal front, a flat-glass front is used. This makes it possible to thoroughly illuminate the dial from the front without the troublesome reflections often encountered with the curved covers of the edgewise types of meters, and enables the whole pointer to be seen, thereby making it possible to take accurate readings from a distance and from any angle.



VOLTMETER. AMMETER. WATTMETER. FREQUENCY METER.

These features of compactness and readability of the new seven-inch meters, combined with the perfectly damped indications and important improvements in the electrical design, mark a distinct advance in switchboard-meter practice. The type TM nine-inch meters embody the same improvements and meet the demand for a larger meter where economy of space is not a prime consideration.

These meters have no moving coils or connections, as they operate on the induction principle; a rotating magnetic field, produced by current in stationary windings, acts on a light metal drum.

The makers state that the construction of meters on this principle has a number of inherent advantages. The absence of a moving coil makes the use of flexible sliding conductors

unnecessary, and greatly simplifies the construction so that repairs are easily made. The lightness of the moving element makes the likelihood of damage to the pivot jewels remote, and reduces jewel wear to an inappreciable minimum. It is well known how seriously the proximity of heavy busbars affects moving-coil and moving-iron instruments, even when special internal shields or iron cases are provided. Freedom from the effects of external field, and high torque, are among the advantages gained by utilizing the induction principle. This principle has now come to be recognized as the most practicable principle in the case of alternating-current watt-hour meters.

A feature of these meters is the perfectly damped character of the readings. The pointer does not overshoot, even with full-scale variations. This remarkable result is not obtained at

CASE REMOVED.

the expense of accuracy, but by providing a special damping disk moving in the concentrated magnetic field of two permanent magnets. This "super-damping" of the indications will be particularly appreciated by those using meters on circuits or generators operating in parallel, where there is likely to be a rhythmic interchange of power, or pumping. The damping required to prevent wide oscillations of the pointer on such service can be obtained only by means of permanent-magnet dampers. Compared with air dampers this method is said to be not only more efficient, but so rugged in construction as to be "fool-proof."

Exceptionally high torque is developed in the meter, and this makes possible the use of substantial controlling spring. This spring is of a special alloy and is tempered and artificially aged to insure permanence under all conditions. Extremely simple zero and calibrating adjustments are provided.

Extremes in weight have been avoided in these instruments. Wherever the principle of operation permitted, the weight has been made as small as possible consistent with substantial and serviceable construction. To this end the movement is made self-balancing to avoid the use of counterweights, the weight of the control spring is carried on the stationery support, all moving parts except the shaft

MOVING ELEMENT.

are of aluminum, and the pointer is an aluminum punching of U-cross-section. On the other hand, wherever weight is required for strength it is present. The result is a moving element heavy enough not to be delicate, yet light enough to cause no damage to the jewels during shipment and to cause no wear in use. The ratio of torque to weight is claimed to be higher than has ever been obtained before in commercial measuring instruments. The meters are therefore highly sensitive and accurate without being delicate.

The fact that the meter element can be removed from the case as a unit, allows all parts to be inspected without changing the calibration. The

AMMETER.

parts can be very easily removed and replaced and the absence of moving coil or flexible connections makes this possible without danger of damage.

In these meters the previous designs of Westinghouse indicating meters have been thoroughly revised to eliminate the effects of temperature changes, either of the air or of the meters themselves, and inaccuracies due to variations in frequency. The frequency meters, power-factor meters and synchroscopes are of the well known Westinghouse types with the added improvements developed for the rest of these lines.

The types SL and TL direct-current meters supplement the line of alternating-current meters and resemble them very closely in appearance. They have glass covers, the same types of cases and similar dial appearance, with scales eight inches long.

The meters operate on the d'Arsonval principle, and have a moving coil and permanent magnet, which avoids all residual error. They differ, however, from most meters employing this principle in having only one gap in the magnetic circuit. The moving coil is

AMMETER.

pivoted at one edge, incloses a circular pole piece, and the other moves through the air gap. With this construction the moving element can be removed and replaced without disturbing the magnetic circuit, and the entire magnetic circuit is magnetized, aged and tested as a unit, thus preventing any variation in the strength. The shape of the permanent magnet is such as to shield the meter from external magnetic fields and make it free from effects of nearby conductors.

The moving coil is mounted on a light metal frame, the motion of which in the air gap of the magnets produces a damping effect that makes the readings practically dead-beat. As the coil is pivoted at one edge, its weight counterbalances that of the pointer, resultings practically dead-beat. As the coil ment. This leads to long life of pivot jewels and accuracy of reading. The meters are said to have exceptionally high full-load torque.

The dials of all the meters here described are hand calibrated on white cards, thus insuring extremely accurate scales.

Current Electrical News

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

The Public Service Commission, First District, has sent to the Board of Estimate and Apportionment a set of resolutions laying out a new rapid transit railroad, from the Battery under the East River and through Atlantic Avenue, Brooklyn, to connect the proposed Brooklyn Rapid Transit subways in Manhattan with the Fourth Avenue subway in Brooklyn. The proposed route, which is laid out to provide one of the new subways to be operated by the Brooklyn Rapid Transit Company, under the Wilcox-McAneny report, will be 1.9 miles long and the cost of construction, it is estimated, will be about $8,200,000. The new road will be a two-track subway under the East River and four tracks through Atlantic Avenue.

The Public Service Commission, in answer to the request of the State Senate, has expressed its views on what legislation it considers necessary. It has declared that the Public Service Commissions law should be amended so as to prohibit the right of review by certiorari of the Commissions' decrees regarding rates and services of public-service corporations, and also that the stock-corporation law should be altered so as to place under the approval of the Commission the securities to be issued by reorganized companies .

The Public Service Commission, Second District, has authorized the Buffalo & Lackawanna Traction Company to expend the sum of $196,000, part of the proceeds of the sale of bonds heretofore authorized, for the purchase of rolling stock and equipment. $101,000 of this sum was originally provided for reconstructing a bridge over the ship canal and a viaduct over the tracks of the Erie Railroad; but it is found that it is not necessary that it be used for that purpose at this time. The company also has $95,000 saved from the amount thought necessary to construct its roadbed originally, and it is proposed to devote these two sums to the purchase of rolling stock and equipment.

The Public Service Commission, First District, gave a hearing, July 6, at the request of the Board of Aldermen, on a petition for the restoration of universal transfers in Manhattan, as they were before the disintegration of the Metropolitan Street Railway system.

E. G. Connette, transportation engineer to the Commission, exhibited a map showing that transfers to the number of 151 have been abandoned in Manhattan, while 168 remain in force.

Assemblyman Mark Goldberg criticised the Commission because it was six months after the passage of the bill giving it power, in June, 1910, before it ordered any transfers.

COMMISSION NEWS FROM WISCONSIN.

(Special Correspondence.)

The Railroad Commission has handed down its second decision in the Madison Gas & Electric Company case, reducing rates as follows:

Former Net Rate.		Present Net Rate.	
Primary	14 cents.	Primary	12 cents.
Secondary	8.5 cents.	Secondary	8 cents.
Excess	5 cents.	Excess	4 cents.

It is estimated that this cut will reduce the company's yearly revenue about $24,000. No reduction is being made at this time in the gas rates.

This is the second reduction made in the company's rates in the last year and a half, the original maximum rate being sixteen cents per kilowatt-hour. The reasons given for the further reduction are the economies effected by the company in generating power during the past year and the enormous increase of sales brought about by the inducements offered to use additional power under the Commission's form of rate.

The Commission finds, for example, that while residence consumers have increased thirty-four per cent, the number of lamps connected for this class of service has increased fifty-three per cent and the kilowatt-hours sold seventy per cent. The large increase of demand and use of current for this class has increased revenues even under the reduced rate thirty-five per cent for the class.

Stores have actually decreased their number of lamps connected, but have increased the amount of current used twenty-five per cent. As an inducement to larger installations, the Commission has changed its rule as to the number of lamps to be considered active. Hereafter only fifty-five per cent of all lamps over fifty will be considered active. Furthermore lamps used exclusively in space used for storing goods are placed at twenty per cent active.

Some idea of the extent of the reduction in electric rates may be gathered when it is stated that one store with an installation of 201 lamps will have its bills for the year reduced $119.71, and a theater with 348 lamps will obtain a reduction of $202.24 for the year.

The Commission finds further that its estimates as to loss in revenue to the company under its previous order have been borne out during the past year. Applying unit revenues realized in the years ended December 31, 1908, and June 30, 1909, to the sales for the year under which the new rate has been effective, a decrease in revenue for gas and electric service is noted amounting to $18,802 and $18,308, respectively. Of this amount on a 1908 basis $9,431 was a decrease occurring in electric sales due to the new rate, and $9,371 due to gas sales. An estimated decrease in earnings on the basis of this year is estimated in the previous decision for the electric department as $11,429 and for the gas department as $6,896, a total of $18,325 as against the $18,802 noted above. Similarly the total anticipated cut for the year ending June 30, 1909, was $18,881 as against the $18,308 noted above.

A comparison of the unit costs of the electric plant for the years ending June 30, 1909, and March 31, 1911, is shown in the following summary given in the decision:

Class of Expense.	Units.	No. of Units.	Unit Cost Year Ending March 31, 1911.	Unit Cost Year Ending June 30, 1909.
Consumer	Meter	3,809	$7.566	$9.042
Demand	Active Lamp Months	504,828	5.108 cents	5.55 cents
Output	Kilowatt-Hours Sold.	1,821,374	4.182 cents	4.52 cents
Consumer plus demand.	Active Lamp Months	504,828	10.82 cents	11.99 cents
Total	Kilowatt-Hours Sold.	1,821,374	7.18 cents	7.782 cents

The output as referred to, includes all those expenses which are proportional to the power generated, while the demand charge depends rather on those items involved in the capacity of the plant, such as interest on investment, etc., In the customer's charge are included the remaining items of expense which depend on the cost of giving him proper service.

Analysis of the connected load and consumption of all of the commercial lighting consumers shows the following percentages of the total current sold to this class according to the amount sold under the primary, secondary and excess rates. Primary 38.59 per cent; secondary 36.24 per cent; excess 25.17 per cent.

The new rate schedule as ordered by the Commission is as follows:

Primary rate: Twelve cents net or thirteen cents gross per kilowatt-hour for current used equivalent to or less than the first thirty hours use per month of active connected load.

Secondary rate: Eight cents net or nine cents gross per kilowatt-hour for additional current used equivalent to or less than the next sixty hours use per month of active connected load.

Excess rate: Four cents net or five cents gross per kilowatt-hour for all current used in excess of the above ninety hours use per month of active connected load.

COMMISSION NEWS FROM OHIO.

(Special Correspondence.)

With the change of title of the Railroad Commission of Ohio, to the "Public Service Commission," power is given to public service corporations to appeal to the Commission regarding rates, etc. This is of especial interest in the case of the Toledo Railways & Light Company, which has been experiencing some rate difficulties. The trouble began some time ago when the City Council passed an ordinance making the legal rate to be charged by the company for electric lighting eight cents per kilowatt-hour, with one-per-cent discount if the bill was paid in a given time. The rate charged by the company is nine cents per kilowatt-hour, with a ten-per-cent discount for payment within specified time. Immediately upon the passage of the ordinance by the Council the company issued a statement saying that it would not accept the rate specified. Since then both sides have been prepared for the ultimate controversy. City Solicitor Cornell Schrieber filled the local newspapers with advice to the people not to pay more than the rate prescribed in the ordinance and offers to bring suits to compel the company to accept that rate.

The provisions of the recent act are of the utmost importance not only to Toledo in the present crisis but to every municipality in the state. Should the company appeal to the Commission, as it is very probable it will do, and the Council's rate is affirmed, the company will be compelled to refund to Toledo citizens the difference between the old and new rate from the time the Council's eight-cent figure went into effect. Another important provision of the law provides that if the Commission fixes a rate satisfactory to the company, the new rate will become effective,

unless within sixty days after the acceptance three per cent of the electors of the city appeal to the Commission for further revision. H.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

TO DAM THE ARKANSAS RIVER.—A plan is being considered for damming the Arkansas River at the Royal Gorge to secure power for a hydroelectric installation. The dam proposed would be built west of Canyon City, the power generated being supplied to Pueblo, and other manufacturing centers in the Arkansas valley.

A NEW BRUNSWICK PROJECT.—The Eel River Power Company has lately finished the survey of the lakes in the vicinity of Canterbury and has also surveyed the site for two dams near Benton, N. B. The work was done under the direction of Fred Baird. It is the intention of the company to furnish power in Fredericton and St. Stephen, Woodstock and other towns and to establish electric light and power plants in these towns. The Woodstock and St. Stephen plants will probably be established as soon as the company erects its new power house.

LIGHTING AND POWER.

(Special Correspondence.)

PAWHUSKA, OKLA.—This city will vote on the issuance of $10,000 in electric light improvement bonds. P.

MACATAWA, MICH.—The new lighting system installed at Macatawa Park was recently put in service.

LISBON, N. D.—The Bemmels Milling Company is considering the establishment of an electric light plant here. P.

CHAMBERLAIN, S. D.—The Citizens' Light & Power Company has asked a vote on the extension of its franchise. P.

SCRANTON, PA.—Tungsten lamps are to be installed in the station of the Delaware & Hudson Railroad here.

LAKE CHARLES, LA.—The Electric Construction Company has been incorporated with a capital stock of $25,000. P.

SHAWNEE, OKLA.—The Shawnee Gas & Electric Company is to rebuild its power plant which recently burned, causing a loss of $150,000. P.

NEW YORK, N. Y.—The Call Electric Light & Power Company has been incorporated by H. J. Eder, P. J. Eder and E. H. Mason. The capital of the concern is $200,000.

BAY SPRINGS, MISS.—The Bay Springs Electric Company has been incorporated with a capital of $10,000. The incorporators are C. E. Burnham, L. L. Denson and E. A. Denson.

BARNESVILLE, GA.—The Central Georgia Power Company has notified the local authorities that the power will be brought into the city and ready for use by September 1.

MACKINAW, ILL.—The City Council has named a committee to investigate decorative lighting systems in other cities with a view to establishing a similar illumination here. Z.

GIBSON, ILL.—The Electric Light, Heat & Power Company was recently incorporated with a capital of $100,000. The incorporators are A. Hood, H. D. Clarke and James Hood.

MARINETTE, WIS.—The thirty new arc lamps contracted for from the Menominee & Marinette Light & Power Company have been put in operation, making a total of 121 lamps of this type.

SHERIDAN, IND.—The City Council has been negotiating with out-of-town parties for the sale of the municipal light plant. The purchasing company will be expected to make extensive improvements.

NEWPORT NEWS, VA.—This city has voted down a bond issue of $150,000 for the erecting and maintaining of a municipal electric lighting plant. The total vote for the plant was 350 and there were 523 votes against.

AUGUSTA, GA.—A permit has been issued for the new building which is to be erected at the power house. The permit was for $120,000. The new power plant will add several thousand horsepower to the present plant.

BALTIMORE, MD.—A municipal heating, lighting and power plant is being considered. The plant would be installed in conjunction with the pumping station and would heat and light the City Hall and annexes, and the Courthouse.

SALT LAKE CITY, UTAH.—The Piute County Electrical Company has been incorporated to engage in an electrical lighting system in Piute County. The capital stock is $12,000. M. M. Steele is president; Fred Miner, vice president; and Joseph Steele, secretary and treasurer.

MANCHESTER, CONN.—The South Manchester Light, Power & Tramway Company is rebuilding its high-tension transmission system. The Hartford Electric Light Company furnishes power to the company at 10,000 volts, this being transformed to 440 volts for use in the mills.

CENTRALIS, WASH.—The erection of the new power plant of the Washington-Oregon Corporation is progressing rapidly, and the work is being pushed to a speedy completion. The cost of the new power plant will be about $75,000 and on completion will be one of the most modern in the state.

CONNERSVILLE, IND.—E. D. Johnson, president of the local hydraulic company, is preparing to let a contract to construct a dam across Whitewater River and build and equip two electric power plants, one on the canal at the old water works and the other at the south end of the city, near a mill. S.

SOUTH BEND, IND.—The Indiana & Michigan Electric Company is planning to make extensive improvements on its plant, including a large intake pipe from the St. Joseph River to supply water for condensing purposes at the plant. Underground conduits will also be placed, the whole costing over $100,00. S.

GRANITEVILLE, MASS.—The Lowell Electric Light Corporation has petitioned the board of selectmen for locations for its poles and wires in the villages of Brookside, Westford Centre, Forge Village and Graniteville It is thought that the street lighting system will be installed by September 1, if not before.

IRON MOUNTAIN, PA.—The Peninsula Power Company closed the contract for its power machinery. The initial installation of the power company will include two turbine water wheels, although the flume to be constructed will have room for five wheels. The contract covers generators and all other equipment for the power house.

BARTLESVILLE, OKLA.—The Bartlesville Light & Water Company has been sold to Ira L. Kobe of Chicago for $90,000. Kobe represented the holders of the second mortgage issue on the plant. Kobe asserts that improvements in accordance with the demands of the Oklahoma Corporation Commission will be made at once.

SCRANTON, PA.—A permit has been issued authorizing the Scranton Electric Company to erect an addition to its power plant on North Washington Avenue at an estimated cost of $70,000. The addition is one of the improvements included in the $1,000,000 worth of improvements announced by the company in a plan for the general betterment of its service

PASSAIC, N. J.—A meeting has been held to determine the advisability of this city erecting a municipal lighting plant and the Mayor and Public Safety Committee have been authorized to engage an engineer to ascertain the cost of the production and distribution of the power current. The engineer is also to advise as to the probable cost of placing the wires on prominent streets in conduits.

PHILADELPHIA, PA.—Plans have been completed by John T. Windrim for a $50,000 plant for the Philadelphia Electric Company, to be erected at Twenty-sixth and Christian Streets. This plant will be used for the purpose of supplying extra power to the Philadelphia Rapid Transit Company, and is one of the innovations for the improvement of the transit conditions in this city, as planned by the new interests in the company.

TIFFIN, O.—The Tiffin Electric Company, which controlled the power and electric light plants at this place, was absorbed Friday, June 29, by the Ohio Light & Power Company, the new concern organized by the syndicate owning the Tiffin and several other plants. The consolidation was made for the purpose of uniting the properties so that an issue of $1,500,000 worth of bonds could be secured. The Knickerbocker Trust Company, of New York, holds the mortgage. H.

KENTON, O.—The plant of the Kenton Electric Company has been sold to the Hardin-Wyandot Lighting Company for $160,000. The new company will furnish current to Forest, Dunkirk and Upper Sandusky. A new plant to cost $60,000 will be begun here at once. Plants owned by the Hardin-Wyandot Lighting Company at Forest and Upper Sandusky are to be dismantled. S. M. Blake, of Providence, R. I., representing a number of Eastern captalists, and William Roberts, of Cleveland, were interested.

SAN FRANCISCO, CAL.—On July 1 the City Electric Company went under the control of the Great Western Power Company. The City Electric Company has a franchise to extend its service in all parts of San Francisco, and will enter actively into competition with the San Francisco Gas & Electric Company. The Great Western Power Company has long had its power wires running into Oakland from its plant in Butte County, and the acquisition of the City Electric was necessary to increase its distributing territory.

TOLEDO, O.—Nearly $25,000 has been raised for a new power building and preliminary plans have all been made. The company will issue $200,000 worth of bonds, of which one-half is to be sold immediately. The owners of the land on which the structure is to be reared have agreed to take stock for the land value at par. The property as appraised by the real-estate board is worth about $90,000. The estimated cost of the buildings complete is $360,000. The company will be known as the Toledo Factories Company and will be capitalized at $300,000. H.

TOLEDO, O.—A company with a capitalization of $1,000,000 has been organized to develop the hydraulic possibilities of the Maumee and Auglaize Rivers. A statement was made by one of the officials that the new company intended furnishing electric power to many cities of Northwestern Ohio. Eight counties will be included in the territory. One power plant will be erected at Maumee, in Lucas County, and another on the Auglaize River at Defiance. This plant, it is expected, will furnish 3,000 kilowatts. The company will be known as the Auglaize Power Company and will have its headquarters in this city.

ELECTRIC RAILWAYS.

(Special Correspondence.)

ABERDEEN, S. D.—The Aberdeen Railway Company is extending its line to Wylie Park. C.

KEOKUK, IOWA.—The Interurban Railway Company has been organized to build a line to Fort Madison. C.

WATERLOO, IOWA.—The Waterloo, Cedar Falls & Northern is planning the extension of an interurban line to LaPorte City. C.

ERIN, MINN.—There is an agitation for the construction of an electric line to Thief River Falls and thence possibly to Fargo, N. D. John T. Lattimore is interested. C.

FINDLAY, O.—Service was recently inaugurated over the new interurban line between Fostoria and Fremont. Through cars will probably be run between Findlay and Cleveland.

ROCKFORD, ILL.—An electric line costing around $1,600,000, connecting Rockford and Dixon, and running through Stillman Valley, Oregon and Byron, a distance of forty-two miles, is being planned. The population along the line is figured at between 60,000 and 90,000.

LOS ANGELES, CAL.—The Pacific Electric Company is spending approximately $550,000 in improvements and betterments of the system. Additional cars and substation equipment is the larger item of expense in the half million improvement fund. Eighty-five new cars will be placed in service to take care of the increasing demand for more car accommodation. The cost of these cars will be about $400,000. New motor-generator sets are to be installed in the substations at Redondo, Pasadena, Playa Del Rey, Vineyard and other points.

KOKOMO, IND.—The Kokomo, Frankfort & Western Traction Company has incorporated for the declared purpose of building and operating an electric traction line to connect Kokomo, West Middletown, Rushiaville, Forest, Avery, Michigantown and Frankfort. The capital stock is $10,000. The company also proposes to build an electric light and power plant for the purpose of supplying electricity for light and power to the inhabitants of the towns, cities and communities through which the road runs. The incorporators and directors are George J. Marrott, Thomas McReynolds, L. J. Kirkpatrick, John B. Carter, Lee Hall, J. H. Holliday and P. H. Palmer. S.

DALLAS, TEX.—The Stone & Webster Engineering Corporation, which is preparing to construct an interurban electric line between Dallas and Waxahachie, Tex., a distance of about thirty miles, will soon finish securing the right-of-way and will thereupon let the contract for construction. The proposed line is to ultimately be extended south to Waco and also to Corsicana, and preliminary steps towards carrying out these enlarged plans are now in progress. It is reported that it is the intention of the Stone & Webster interests to build a north and south interurban electric line that will reach from Sherman on the north to Galveston on the south, traversing the most populous portion of the state and affording transportation outlets to many towns of considerable size. The Stone & Webster interests are already constructing an interurban electric railway between Houston and Galveston, fifty-one miles, which will be an important link in the proposed line through the state. D.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

FAIRMOUNT, N. D.—The Fairmount Rural Telephone Company is building a ten-mile line. P.

HUMBLE, TEX.—The Home Telephone Company has been incorporated with a capital stock of $3,500.

KELLOGG, MINN.—The Greenfield Farmers Telephone Company has been incorporated with a capital stock of $10,000. P.

GATESVILLE, TEX.—Improvements are being made in the local telephone system. The telephone building was remodeled.

CUMBERLAND, LA.—A new switchboard is to be installed in the telephone exchange here and the entire system remodeled. The approximate cost of the work will be $75,000.

REDDING, CAL.—The capacity of the exchange of the Redding Telephone Company has been increased from 500 to 1,000 telephones. Improvements involving an expenditure of $3,000 are being made

SUFFOLK, VA.—The Nansemond County Board of Supervisors has granted permission to the Atlantic Coast Telephone Company to construct, operate and maintain its line of poles and wires along the county roads.

WHEELING, W. VA.—The Bell Telephone Company is making a number of improvements to its local equipment. A new switch board is being installed at the local central office, and the installation of other new and modern equipment will follow. The work will be completed about the middle of August.

JONESBORO, LA.—Work on the new telephone plant has been started by C. P. Couch, superintendent of construction for the Southern Telephone Company. The old plant will be taken out and a new and modern system installed. The new system will require about 150 poles, and 1,500 feet of cable will be used in the business part of town. The new plant will cost approximately $3,000.

ELECTRICAL SECURITIES.

The Lehigh Valley Transit gross earnings in June were $99,409, an increase of $8,460. These are the largest gross earnings ever reported in the month of June by the railway lines alone.

A special meeting of the stockholders of the United States Light & Heating Company will be held in Portland, Me., July 17, to vote on a proposition to change the par value of the shares of the capital stock of the company from $10 a share to $100 a share, but without change of the total amount of capital stock, so that hereafter capital stock shall be divided into 25,000 preferred and 150,000 common shares, of the par value of $100 each.

Subscriptions are being received by the National City Bank of New York for the total authorized issue of $30,000,000 Chicago Elevated Railways three-per-cent five-year gold notes, dated July 1, 1911. Offering price is ninety-eight and one-half and accrued interest, yielding five and one-half per cent. Interest is payable January and July in Chicago and New York. The notes are callable as a whole at par and accrued interest on thirty day's notice. Henry A. Blair, chairman of the board of directors, in a letter to the bank says that the earnings are ample to meet fixed charges, including the notes, and that economies of about $1,000,000 should be effected by unification.

The directors of the American Power & Light Company, which is controlled by the Electric Bond & Share Company and affiliated interests, have authorized an issue of $2,200,000 ten-year six-per-cent gold notes dated August 1, 1911. Holders of record as of July 24, of preferred stock and voting trust certificates for common stock will be allowed to subscribe at par to the extent of twenty-five per cent of their holding. The right to subscribe will expire at the close of business on September 1, 1911. The entire amount of notes offered to stockholders has been underwritten by the Electric Bond & Share Company. The notes are to be issued to provide partially and temporarily for a floating debt of the American Power & Light Company amounting to $3,359,221, as of May 31, 1911, and later to increase its working capital. This debt was created by expenditure of funds for water rights and valuable lands necessary for water power developments, by advances made to the Pacific Power Company and by the purchase of $400,000, par value of the preferred stock of the Kansas Gas & Electric Company.

DIVIDENDS.

Associated Gas & Electric Company, preferred quarterly dividend of one and one-half per cent, payable July 15.

Cuyahoga Telephone Company, preferred quarterly dividend of one and one-half per cent, payable July 31.

Railways Company General; regular quarterly dividend of one per cent, payable August 1.

Sierra Pacific Electric Company; quarterly dividend of $1.50 per share, payable August 1.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.	July 10.	July 3.
Allis-Chalmers common	8	8
Allis-Chalmers preferred	28¼	29½
Amalgamated Copper	69½	69½
American Tel. & Cable	*78	*78
American Tel. & Tel.	138¼	139⅛
Brooklyn Rapid Transit	82¼	81⅜
General Electric	163	161
Interborough-Metropolitan common	17½	17½
Interborough-Metropolitan preferred	50	50
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common.	88½	89
Mackay Companies (Postal Telegraph and Cables) preferred	73½	74
Manhattan Elevated	135	133
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
Pacific Tel. & Tel.	47½	49¼
U. S. Steel common	78⅜	78⅝
U. S. Steel preferred	118	118¼
Western Union	79½	78½
Westinghouse common	76¼	75¼
Westinghouse preferred	*111	111

*Last price quoted.

BOSTON.	July 10.	July 3.
American Tel. & Tel.	138¼	139⅛
Edison Elec. Illuminating	281	280
General Electric (ex-dividend)	160	161
Massachusetts Electric common	22½	22¾
Massachusetts Electric preferred	93¾	93¼
New England Telephone	145½	145
Western Tel. & Tel. common	18	18½
Western Tel. & Tel. preferred	96½	96½

PHILADELPHIA.	July 10.	July 3.
American Railways	43⅜	43½
Electric Company of America	12⅛	12⅛
Electric Storage Battery common	54½	53¾
Electric Storage Battery preferred	54½	53¾
Philadelphia Electric	17⅜	17¼
Philadelphia Rapid Transit	20⅜	19¼
Philadelphia Traction	84	86
Union Traction	49½	49

CHICAGO.	July 10.	July 3.
Chicago Railways, Series 1	87½	85
Chicago Railways, Series 2	25½	27½
Chicago Subway	3⅞	4
Chicago Telephone	120½	121
Commonwealth Edison	134½	129½
Metropolitan Elevated common	27	25
Metropolitan Elevated preferred	74½	74

PERSONAL MENTION.

THOMAS A. EDISON has been elected an honorary member of the Automobile Club of Paris.

SAMUEL INSULL, president of the Commonwealth Edison Company, of Chicago, sailed recently for a four weeks' trip to London.

CARL R. GRAY has been elected president of the Spokane & Inland Empire Railroad Company. Mr. Gray succeeds Jay P. Graves, resigned.

W. C. HORNBERGER recently read a paper entitled "The General Education of an Engineer," before the Science Club of the Phoenix Union High School, of Phoenix, Ariz.

CHARLES A. PARSONS, inventor of the steam turbine which bears his name, was knighted upon the occasion of the coronation ceremonies in London. He is an honorary member of the Institution of Electrical Engineers and a fellow of the Royal Society.

W. L. CANDEE, president of the Okonite Company, on Saturday of last week took an aeroplane flight at Garden City, Long Island, with Thomas Sopwith, the English aviator. Captain Candee's weight is 260 pounds, but the aeroplane carried the weight of the two men without difficulty.

THOMAS DOWNS, of Springfield, Ill., has been named by the State Board of Charities as consulting engineer and will have charge of the electrical and mechanical work at the seventeen charitable institutions of the State of Illinois. Considerable new electrical work will be done as the result of appropriations made at the last session of the legislature.

JAMES A. EWING, director of naval education in England and author of the well known work on "Magnetic Induction in Iron and Other Metals," was the recipient of coronation honors on the occasion of the recent festivities in London. He is a fellow of the Royal Society and was formerly professor at Cambridge. Professor Ewing was made a Knight Commander of the Bath.

LOUIS H. EVANS and HUGH PATTERSON have been appointed special engineers by the Chicago Association of Commerce to prepare plans for the complete electrification of all steam terminals in Chicago. Mr. Evans was formerly chief engineer of the Chicago Junction Railway, and Mr. Patterson supervised the electrification of the Pennsylvania terminals in New York.

H. F. GURNEY, one of the widely known electric elevator men of the country, has had an interesting connection with this industry. Back in the early nineties when Otis and Eickemeyer, Sprague and Pratt were developing the electric elevator, H. F. Gurney, at that time a young graduate of Stevens Institute, entered the employ of the Sprague Elevator Company. It was a period when faith in the smooth running high-speed hydraulic elevator was firmly established and the electric elevator was in his infancy. The worm-gear drum-type electric machine first installed by Otis in 1889, an evolution of the worm-gear steam passenger elevator, seemed unfit for any but moderate loads and speeds and the hydraulic elevator was without a real competitor until Frank J. Sprague introduced the Sprague-Pratt horizontal-screw multiple-sheave machine. The first important Sprague installation was in the then "towering" Postal Telegraph Building, New York. Previous to this Mr. Gurney had allied himself with the Sprague Company and his subsequent career has been closely identified with the development of the electric elevator. From this time on the field of the electric elevator rapidly broadened, and coincident with this growth, was Mr. Gurney's rise in the Sprague organization. He was successively draughtsman, chief draughtsman, shop superintendent, construction superintendent and general superintendent of construction for the Sprague Elevator Company and its subsidiary the Metropolitan Electric Construction Company. When in 1898 the principal elevator companies, including the Sprague, were combined under the corporate title of the Otis Elevator Company, Mr. Gurney was appointed assistant superintendent of construction, and later general superintendent of construction in charge of all work east of Chicago including not only electric machines, but also hydraulic, plunger, steam and belted. Among the notable installations made under his direction were those in the Broad Exchange, Metropolitan Life and Park Row Buildings and the Waldorf-Astoria Hotel in New York. In 1905 Mr. Gurney acquired the controlling interest in the National Elevator & Machine Company, of Honesdale, Pa. This company, under Mr. Gurney's management, has met with increasing success. The business has been conducted as the National Elevator Company, but on June 1 the Gurney Elevator Company, of New York, and the Gurney Electric Elevator Company, of Honesdale, Pa., and Boston, succeeded to the old company.

H. F. GURNEY.

A. N. FOX, advertising manager of the Benjamin Electric Manufacturing Company, Chicago, has just returned from a three weeks' combined business and pleasure trip to the Pacific Coast. Mr. Fox reports that the prospects for a large fall trade are exceedingly promising in the West.

HERBERT B. BROOKS, who is head of the section for testing electrical instruments in the Bureau of Standards, has been appointed a special representative of the Bureau of Manufactures, Department of Commerce and Labor, to investigate certain phases of the electrical industry in Europe. He will leave this country about August 1, and be gone for six months or a year. He will pay particular attention to the manufacture of electrical instruments abroad.

EVAN J. EDWARDS has recently been appointed associate engineer in the engineering department of the National Electric Lamp Association, Cleveland, O. Mr. Edwards was instructor in electrical engineering at the Massachusetts Institute of Technology for three years after his graduation from the University of Iowa, in 1907. For the past year he has been in charge of the course of instruction in illuminating engineering which is given to new technical graduates coming with the National Electric Lamp Association.

J. G. HENNINGER, of Cleveland, O., delivered an address on "Jewelry Store and Window Illumination" on June 27 at the annual convention of the Ohio Retail Jewelers' Association, which was held at Cedar Point, O., June 26-28. Mr. Henninger's paper dealt with the various factors to be considered in the choice and location of lamps and of reflectors for satisfactory and efficient results. The talk was illustrated by stereopticon views and was supplemented by a demonstration of several types of reflectors, showing their respective fields of usefulness.

OBITUARY.

A. J. LAMB, assistant cashier for the Toledo Railways & Light Company, died in Toledo, Ohio, on July 7, after an illness extending over four weeks. Besides his mother, he leaves a wife, brother and three sisters. He was a member of the Toledo Lodge of Elks and of the Toledo Cadets' Veteran Corps.

WILLIAM P. SCULLY, manager of the Wall Street branch of the Western Union Telegraph Company, died, on June 29, at his home in Brooklyn, of a complication of diseases. Mr. Scully, who was in his fifty-third year, was for thirty-five years in the employ of the telegraph company. A widow, two daughters and two sons survive him.

AUGUSTUS W. MOTT, son of Jordan L. Mott and grandson of the founder of the Mott Iron Works, died, July 2, at his father's home, of melanotic cancer. Mr. Mott was fifty years old and unmarried. He was vice-president of the Mott Iron Works and his recreation was yachting. He had been a member of the New York Yacht Club for twenty-one years. He was a member, also, of the Larchmont Yacht Club and the Lambs Club.

N. WETMORE HALSEY, head of the banking house of N. W. Halsey & Company, of New York City, died July 1, at New London, Conn. Mr. Halsey organized the firm which bore his name, and its business extended until it now has offices in Chicago, Philadelphia and San Francisco, as well as in Manhattan. He was a director of the Electric Properties Company, Netherlands Tramways Corporation, and the Pacific Gas & Electric Company, of San Francisco. Born in Forreston, Ill., in 1856, Mr. Halsey was educated at Beloit and the Union College of Law in Chicago, and practised law until 1886 in Chicago, when he became associated with N. W. Harris & Company, bankers. He traveled extensively, investigating and reporting on public and corporate securities as investments. He was resident partner for ten years in New York city for the banking house of N. W. Harris & Company.

LEGAL NOTES.

CANNOT GRANT EXCLUSIVE FRANCHISES.—The Supreme Court of Nebraska holds that cities and villages cannot grant exclusive franchises to public service corporations unless authorized by the legislature so to do, and that the legislature of that state has not authorized cities and villages of less than 5,000 inhabitants to grant exclusive franchises to telephone companies to regulate and maintain poles and wires and a general telephone system upon the streets and alleys and within the corporate limits of such cities and villages.—May vs. City of Gothenburg, 130 N. W., 566.

SUNDH CASE DECIDED.—In an opinion filed in the United States Circuit Court in the suit of Sundh Electric Company against the Interborough Rapid Transit Company for an infringement of United States patents on an electric controller in the compressor plant for operating a signal system, Judge Hazel holds that the electric company has thoroughly established its right to the patent in question and that the device used by the Interborough Company is an infringement of those rights. Suit will now be begun against the Interborough Rapid Transit Company for a perpetual injunction and accounting, damages and costs.

DUTY AND LIABILITY OF AN ELECTRIC LIGHT COMPANY.—In a case where a woman received a heavy charge of electricity while attempting to turn on the current in a droplight, the Supreme Court of Alabama says that an electric light company is not an

insurer against danger or injury in any event; but where it affords the means for the service and undertakes to supply the light, installing wires and apparatus, it is obligated to use a degree of care commensurate with the risks and dangers involved to send a safe current into the building, and a patron has a right to assume that such a current as is consistent with the proper rendering of the service contracted for will be used. It is also the duty of such a company to make reasonable and proper inspection of its appliances, though this duty does not contemplate such inspection as would absolutely forestall injuries. A company having installed the wires and appliances to convey into a building electricity for domestic and lighting purposes and uses, and injury having attended its presence and use, as above stated, the doctrine of res ipsa loquitur, or the matter speaks for itself, as indicative of negligence, applies to cast on the company the burden of negativing its negligence. There occurs to the court no reason why there should be any difference in the shifting of the burden in cases where the injury is suffered in a public way, and where, under the conditions suggested, the injury is suffered on private premises served with electricity by means of wires and appliances furnished by the company.—Alabama City, Gadsden & Attalla Railway Company vs. Appleton, 54 So., 638.

INDUSTRIAL ITEMS.

THE INDIAN REFINING COMPANY, New York, N. Y., announces that its general and executive offices will hereafter be located at No. 17 Battery Place, New York City.

THE DELTA-STAR ELECTRIC COMPANY, 617 West Jackson Boulevard, Chicago, Ill., has prepared standard pages for catalogs which will be distributed to jobbers and dealers. These pages contain data and prices on the various Delta-Star high-tension, train-lighting and Mazdalite-lighting units.

THE HOLOPHANE COMPANY, Newark, O., announces that the Boston office, in charge of H. C. Jones moved into new quarters on June 26. The present address of the office and stock rooms is No. 10 High Street. Announcement is also made of a change in location of the company's New York office to No. 16 East Fortieth Street.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Pittsburg, Pa., reports among other orders, one for three substation equipments, consisting of nine 110-kilovolt-ampere, 33,000-volt, oil-insulated self-cooling transformers, three five-panel switchboards, and the necessary lightning protective apparatus.

THE COMBUSTION APPLIANCES COMPANY, Chicago, Ill., has started the publication of a house organ, under the title, "The Coapco Comet." The company manufactures $C0_2$ recorders, gas calorimeters, gas analysis instruments, and many other specialties applicable to factories, industrial plants or power stations seeking fuel economy.

THE W. H. ZIMMERMAN COMPANY, Chicago, Ill., has reproduced illustrations on a postal card, of different phases of the work of construction on the Lansing, Grand Ledge & Western Railway. The company designs light and power plants of all kinds, manages and operates properties, and also makes investigations and reports.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., is distributing Bulletin No. 1076, devoted to its line of power transformers. This bulletin contains a very complete description of the theory underlying the construction of power transformers and shows illustrations of the various details of manufacture. Tables of efficiency and heating are also included.

THE FEDERAL SIGN SYSTEM (ELECTRIC), Chicago, Ill., includes a descriptive article on the new Harper Memorial Library of the University of Chicago, in the July issue of *The Federalist*. In this building Federal adjustable floor boxes were used exclusively, and illustrations of this type of box, with drawings showing the scheme of adjusting are included in the publication.

THE PACIFIC ELECTRIC HEATING COMPANY, Ontario, Cal., designates the June number of *Hot Points* as the "Bride's Number." Several valuable hints to salesmen are noted together with some suggestions for placing irons. The success of the recent "Hot-point Day" is attested by a number of letters which were sent in to the company from cities where the idea was carried out.

G. L. SIMONDS & COMPANY, Chicago, Ill., has ready for gratis distribution a valuable little publication entitled, "Economical Steam Production," which is a scientific and practical treatise on soot and the modern methods of its removal from steam boilers. The book describes the Vulcan soot cleaner, a product of the company, and illustrates prominent boiler installations in which these cleaners are used.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has issued bulletins No. 3142, 3143 and 3709 describing small motors for various purposes. Bulletins 3142 and 3143 list single-phase alternating-current motors, the former including only back-geared motors, ranging in size from one-third to one-half horsepower. The motors described in the latter are without back gears and are in sizes from one-twentieth to one-half horsepower. Electric buffing lathes described in bulletin No. 3709 are made for either alternating or direct current.

ALLGEMEINE ELEKTRICITATS-GESELLSCHAFT, Berlin, Germany, has issued a comprehensive bulletin describing its electrically-driven winding machine. Numerous illustrations are given of installations with tabulated information relating thereto. Performance curves are also given. A second publication deals with depth indicators and safety apparatus. The Leonard system of control is extensively used.

THE UNTED STATES ELECTRIC COMPANY has issued in its bulletin No. 502, some suggested rules for telephone train dispatching. These rules are a compilation of the requirements which have been generally adopted by the majority of American railways which have installed telephone train dispatching. As reflecting the consensus of judgment of users, these rules are of interest to roads contemplating the change to telephone dispatching. Some general instructions governing the use of the telephone in railroad service follow and it is believed that, as simple as some of these appear, they have an important hearing on the efficient operation of a railway telephone installation.

THE LEEDS & NORTHRUP COMPANY, Philadelphia, Pa., has issued catalogs Nos. 20 and 72. The first, describing and listing moving-coil galvanometers, gives an account of the theoretical considerations involved in the design and use of galvanometers, together with the details of construction of the company's instruments. A second part of the publication lists and describes the various types of instruments and includes a number of illustrations. Catalog No. 72 lists the A. C.-D. C. Comparator. With this instrument alternating-current ammeters and voltmeters can be calibrated rapidly and accurately, from one-twentieth ampere up in the case of the former and from five volts up in the case of the latter.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has received a contract for equipping thirty-five new cars for the Dry Dock, East Broadway & Battery Railroad Company of New York with storage batteries. The work will begin in August and will be continued at the rate of about seven cars per week. One of the officials of the company states that he believes the order is the forerunner of a much more extensive use of storage batteries for urban transportation in cases where trolley competition is absent or objectionable, as is the case with the New York line in question. The Exide batteries to be used in this contract are the latest type to be placed on the market by the Electric Storage Battery Company.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., has placed on the market a new "friction-drive" screwdriver which has found much favor among electricians and is being handled by the leading supply dealers. In this screwdriver the surfaces between the cap and handle engage with the ordinary working pressure used in driving the screw. The spring in the handle releases the friction when the pressure is withdrawn on the reverse movement, and the hand with the rotating cap returns without backing the screw. Screws may be driven in either direction without readjustment. The rotating swivel cap moves with the hand, therefore does not chafe or blister it. There are few parts, and only the best materials are used in its construction.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has just issued bulletin No. 4845 containing illustrations and descriptive matter in considerable detail on its horizontal steam-turbine generators of from 100 to 1,000 kilowatts capacity at 3,600 revolutions per minute, which is the maximum speed possible for use with sixty-cycle alternating-current generators. These units are particularly adapted to industrial and lighting plants requiring the economical generation of a moderate amount of power. In bulletin No. 4818 are described that company's flange couplings and flexible couplings. Bulletin No. 4846, also just issued, contains such information as will enable the prospective customer to select intelligently the switchboard panels best suited to his needs. Bulletin No. 4850 describes the new drawn-wire tungsten filaments with which Mazda lamps are now equipped. Bulletin No. 4852 contains a description of the company's standard fifty-ton locomotive and its equipment, and a statement of features of construction which have made it particularly suitable for the requirements of the heaviest interurban roads. The bulletin contains, also, an information sheet for the use of those considering the adoption of such a locomotive.

DATES AHEAD.

National Electrical Contractors' Association. Niagara Falls, N. Y., July 19-21.

Ohio Electric Light Association. Annual convention. Cedar Point, O., July 25-28.

Indiana Electric Light Association, Annual convention, South Bend, Ind., August 23 and 24.

International Association of Municipal Electricians. Annual convention, St. Paul, Minn., September 12-15.

International Municipal Congress and Exposition. Chicago, Ill., September 18-30.

American Electrochemical Society. Twentieth general meeting, Toronto, Canada, September 21-23.

Illuminating Engineering Society. Annual convention, Chicago, Ill., September 25-27.

American Mining Congress. Thirteenth annual meeting, Chicago, Ill., September 25-30.

American Electric Railway Association. Annual convention, Atlantic City, N. J., October 9-13.

Association of Railway Electrical Engineers. Annual convention, La Salle Hotel, Chicago, November 6-10.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) July 4, 1911.

996,606. GROUNDING CLAMP. Mark H. Bodley and Frank T. Kieffman, Altoona, Pa. Filed Nov. 21, 1910. A corrugated strip of sheet-metal is bent around the upper and lower sides of several parallel horizontal wires to be grounded. Bolts secure the upper and lower parts of the strip between each pair of wires and a ground wire is connected to the lower end of the strip.

996,615. ELECTRIC SWITCH. Henry J. Carrigan, Buffalo, N. Y., assignor to Auto Safety Specialty Co. Filed Aug. 9, 1909. Comprises an annular row of fixed contacts, a rotable contact arm adapted to engage with one or another of these contacts, and a rotatable baffle provided with a cam whereby the contact arm may be disengaged from the fixed contact.

996,616. TIME SWITCH. James Mack Chappel, Dallas, Tex. Filed Sept. 21, 1908. The switch is operatively connected to a motor, which is held inactive until the lock mechanism releases it so as to actuate the switch.

996,618. FIRE ALARM. Alfred W. Comrack, Olyphant, Pa. Filed June 12, 1909. The expansion of a liquid in a tube overbalances a lever that releases a spring motor which closes an electric alarm circuit.

996,620. ATTACHMENT PLUG. James S. Crossley, Solvay, N. Y., assignor to Pass & Seymour, Inc., Solvay, N. Y. Filed Nov. 30, 1908. Consists of a porcelain cap and base, each having a pair of contacts of which one is resilient so as to join with a snap.

996,633. RAIL JOINT. William D. Forsyth, Youngstown, Ohio. Filed Nov. 7, 1910. An insulated joint has sheets of insulation between the fish-plates and rails.

996,647. PROJECTING APPARATUS. Sydney Julian Jacobson, Washington, D. C., assignor to John H. Bruninga, Washington, D. C. Filed Oct. 14, 1909. Combined with a casing, a set of electrodes therein arranged to form an arc and regulating means for the electrodes are means for projecting an image of the arc and electrodes on a screen at one side of the lantern.

996,675. MINER'S LAMP. Grant I. Rawson and Llewellyn B. Shultz, St. Louis, Mo., assignors to Pilley Packing & Flue Manufacturing Co., St. Louis, Mo. Filed Mar 7, 1910. Has a hook passing through the casing and provided with a loop within, a lamp socket clamped against the loop, a lamp in the socket, and a non-frangible insulating filling within the casing and surrounding the socket.

996,676. SECONDARY BATTERY. Grant I. Rawson and Llewellyn B. Shultz, St. Louis, Mo., assignors to Pilley Packing & Flue Brush Manufacturing Co., St. Louis, Mo. Filed Jan. 9, 1911. Is provided with a doubly lined cell and a thick block of insulating material for a cap through which pass the cell terminal connections.

996,701 AUTOMATIC CUT-OFF FOR AERIAL TELEPHONE LINES AND THE LIKE. Louis W. Carroll, Anamosa, Iowa. Filed May 24, 1907. Combined with a divided aerial conductor is an impedance coil in circuit with the parts of the conductor, and a variable resistance shunt between the terminals of the coil, the resistance of the shunt being controlled by the hygrometric condition of the atmosphere surrounding the conductor.

996,713. FREQUENCY-MEASURING INSTRUMENT. Robert Hartmann-Kempf, Frankfort-on-the-Main, Germany, assignor to Hartmann & Braun Actien-Gesellschaft, Frankfort-on-the-Main, Germany. Filed May 31, 1907. Combined with means for producing alternating magnetic impulses in a resonating body exposed to the impulses and responding to those of a certain frequency, a permanent magnet counteracting the magnetic impulses of one direction, a direct-current coil on the permanent magnet, and means to energize this coil.

996,715 SIGN. Harry Hoag, Fort Worth, Tex. Filed Oct. 18, 1909. Incandescent lamps are arranged in a casing so as to illuminate prismatic letters in its front wall.

996,755. TRANSFORMER. Charles Le G. Fortescue, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed July 6, 1908. Has insulating barriers between its high and low-tension coils and a terminal bridge of inverted U-shape attached to and supported by the barriers.

996,758. ELECTRIC HEATING DEVICE. William S. Hadaway, Jr., East Orange, N. J., assignor to Westinghouse Electric & Manufacturing Co. Filed July 24, 1908. The heating unit for an electric flat-iron consists of an insulating plate having edge notches and a central opening, a conducting ribbon disposed as a double helix upon the faces of the plate and engaging the bases of the notches and the side walls of the opening.

996,762. ELECTRIC MACHINERY. Karl Hertwig and Friedel Collischonn, Frankfort-on-the-Main, Germany, assignors to Electricitäts Actien Gesellschaft vorm. W. Lahmeyer & Co., Frankfort-on-the-Main, Germany. Filed May 6, 1903. A motor is connected to a booster for a storage battery. An auxiliary exciter for the booster controls its field so that the booster may cause the battery to discharge into the motor.

996,764. PRIMARY BATTERY. Charles E. Hite, Burlington, N. J. Filed Aug. 16, 1906. Is composed of two receptacles, one of which is divided into compartments or cells by plate electrodes suitably coated on one side with impervious material, all such electrode-plates except one having a zinc plate attached thereto by an aluminum connection.

996,770. COMBINED TELEPHONE AND ELECTRIC LAMP. Frederick J. Kerbel, New York, N. Y. Filed Mar. 27, 1908. A portable lamp standard carries a bell-shaped reflector above the lamps, a transmitter in the upper part of the bell and switchhook for the receiver near the middle of the standard.

996,782. INSULATOR. William S. Moore, Princeton, Ill. Filed Nov. 22, 1910. An insulator for crossing wires has a groove across each of its two faces to receive the line wire and a corresponding hole through the body of the insulator through which a tie wire is passed and secured about the line wire.

996,786. ELECTRICAL CASH REGISTER WITH DISTANT INDICATION. William H. Muzzy, Dayton, Ohio, assignor to National Cash Register Co., Dayton, Ohio. Filed Dec. 26, 1903. The combination with a series of setting elements, of a series of contact pieces controlled thereby, a series of indicators controlled by the contact pieces, devices for breaking the circuit when the indicators have become set, and a magnetic holding device for the contact pieces included in the circuit.

996,804. ALARM INDICATOR FOR BOILING PURPOSES. Georg Schumacher, Wermelskirchen, Germany. Filed Nov. 22, 1909. The escape of steam upon a support decomposes the latter, thus closing an alarm circuit.

996,805. CASH REGISTER WITH DISTANT INDICATION. William F. Schweiger, Dayton, Ohio, assignor to National Cash Register Co., Dayton, Ohio. Filed Feb. 19, 1904. Includes a series of keys, a series of contacts controlled thereby, a series of movable indicators, solenoid actuators for moving the indicators from a position indicating the previous transaction to a position indicating the characteristics of the last entry in the register and retaining same in said position until a suceeding operation of the register, and solenoid stops for arresting the indicators.

996,822. BRIDGING BLOCK FOR DYNAMO-ELECTRIC MACHINES. Frederick William Young, East Orange, N. J., assignor to Crocker-Wheeler Co., Ampere, N. J. Filed Apr. 21, 1910. A slot-closing bridging work consists of an arc shaped iron core with an insulating covering and an enveloping helix of iron wire.

996,833. ELECTRIC TOOL. Charles B. Coates, Chicago, Ill., assignor to Chicago Pneumatic Tool Co., Chicago, Ill. Filed July 20, 1908. A portable electric trade drill has a pilot switch mounted on it and in circuit with it, but not on the machine, is a magnetically controlled main switch which opens the circuit when the work is done or the load reaches a predetermined limit.

996,844. FASTENING DEVICE FOR ELECTRICAL SIGN-RECEPTACLES. Edgar H. Freeman, Trenton, N. J., assignor to E. H. Freeman Electric Co., Trenton, N. J. Filed Apr. 1, 1910. Comprises a resilient socket member fitted to the supporting element and formed with a taper, and a coupling member arranged to wedge the receptacle body in the socket member.

996,848. VAPOR-RECTIFIER SYSTEM. Charles M. Green, Lynn, Mass., assignor to General Electric Co. Filed Aug. 11, 1905. An alternator supplies current to mercury-arc rectifiers through transformers. In series with the direct-current side of one rectifier is a field winding and regulator for the alternator which is arranged to maintain a constant current for the lamps.

996,849. ARC LAMP. Geoge M. Guerrant, Danville, Va., assignor of one-third to William R. Guerrant and one-third to Joseph Overton Boatwright, Danville, Va. Filed Apr. 15, 1910. Two electrode disks are set at an angle so as to contact at their point of engagement with a cylindrical control member driven by a spring motor.

996,850. COMBINED OZONE GENERATOR AND INHALING APPARATUS. Robert P. Guiley, Akron, Ohio. Filed Mar. 14, 1910. Ozone is electrically generated from air that is blown through the machine by a fan and then passes through an oil bath to the mouthpiece.

996,851. CIRCUIT-INTERRUPTER. Ford W. Harris, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed Oct. 8, 1910. An oil switch in which the contacts are separated by a rotary motion.

996,853. TERMINAL FOR ELECTRIC WIRES. Gustave L. Herz, New York, N. Y. Filed Feb. 10, 1910. Comprises a spring yoke fitted to be attached to a wire and a screw-eye, the yoke being provided with arms having convex adjacent faces for snap engagement with the screw-eye.

996,862. ELECTRIC RESISTOR. Rudolf Kraus, Hamilton, On-

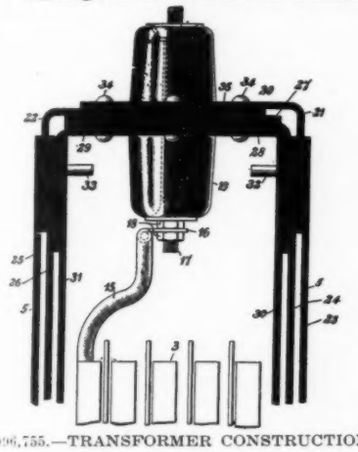
tario, Canada, assignor of one-half to Alexander Loquin, West Allis, Wis. Filed July 14, 1910. Includes spaced end frames, a number of sets of spaced conducting plates arranged in groups between the end frames, a resistance member interposed between the plates of each group, spacing members formed of non-conducting material separating one group from an adjacent group, and tie rods piercing the end frames for holding the several parts in assembled position.

996,865. VAPOR ELECTRIC APPARTUS. Osias O. Kruh, Schenectady, N. Y., assignor to General Electric Co. Filed Jan. 9, 1904. A mercury-vapor tube which has an inclined condensing chamber over each of its electrodes.

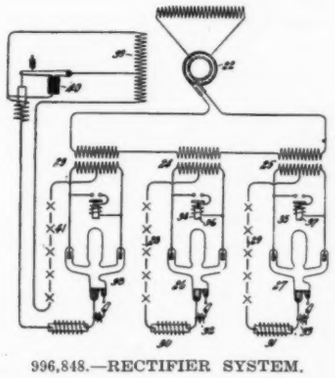
996,874. RELAY. William V. Moak, Schenectady, N. Y., assignor to General Electric Co. Filed Oct. 21, 1908. Relates to the construction of binding-posts for the relay to prevent their rotation.

996,876. JUNCTION BOX. Matthew J. Myers, Syracuse, N. Y., assignor to B. Ives Cooper, Syracuse, N. Y. Filed Nov. 26, 1907. Renewed Apr. 29, 1911. Is provided with an insulating cap with openings closed by frangible closures, the entire cap being covered by a thin veneer of glaze.

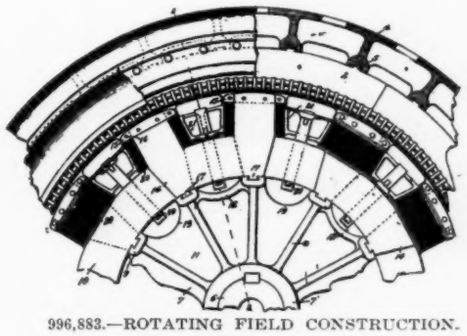
996,878. INSULATING BUSHING. Louis C. Nichols, Milwaukee, Wis., assignor to Allis-Chalmers Co. Filed Oct. 25, 1909. A bushing for the entrance of a conductor to a high-potential apparatus has a number of flat insulating rings assembled by tie rods into a cylinder separated from the axial conductor by oil.



996,755.—TRANSFORMER CONSTRUCTION.



996,848.—RECTIFIER SYSTEM.



996,883.—ROTATING FIELD CONSTRUCTION.

996,883. DYNAMO-ELECTRIC MACHINE. Henry G. Reist, Schenectady, N. Y., assignor to General Electric Co. Filed Mar. 1, 1905. A revolving-field structure is provided with outwardly extending polar portions having ventilating spaces between them, and wings or barriers located in planes transverse to the axis of rotation extending between adjacent polar portions at the outer ends thereof.

996,894. SYSTEM OF ELECTRICAL DISTRIBUTION. Emmett W. Stull, Milwaukee, Wis., assignor to Allis-Chambers Co. Filed July 18, 1908. A trolley circuit of variable voltage has a second circuit supplied therefrom, a generator in the connection between the two circuits, a regulating device connected across the circuit of variable voltage and comprising a Wheatstone bridge having similar counter-electromotive-force devices in two opposite arms, the field winding of the generator being connected in the bridge wire of the Wheatstone bridge.

996,895. COMMUTATOR FOR ELECTRIC MACHINES. William S. Sutton, Madison, Wis.; assignor to Allis-Chalmers Co. Filed Sept. 23, 1907. A bond of fusible insulating material joins the bars to the supporting rings and insulates them therefrom.

996,927. ARMATURE CORE. John D. Ihlder, New York, N. Y., assignor to Otis Elevator Co., Jersey City, N. J. Filed Dec. 8, 1904. A laminated core for comparatively large machines has a number of spacing disks, some of the members of which are of different diameters from the others, and each provided with teeth twisted so as to prevent a projecting edge from the plane of its surface.

996,933. MAGNETIC-TRACTION WHEEL-DRIVE ELEVATOR. David L. Lindquist, Yonkers, N. Y., assignor to Otis Elevator Co., Jersey City, N. J. Filed Dec. 16, 1905. A motor drives an electromagnetic traction sheave which is controlled from the car, as are the motor and braking apparatus.

996,936. APPARATUS FOR EVACUATING INCANDESCENT-LAMP BULBS. John R. Massey, Cleveland, O., assignor to National Electric Lamp Co., Cleveland, O. Filed Dec. 20, 1905. Renewed Dec. 3, 1910. Comprises a plurality of exhaust connections, means for shifting a bulb from one connection to another, and means for applying heat exteriorly to the bulb while in communication with one of the exhaust connections.

996,951. METHOD OF AND APPARATUS FOR DEVIATING ELECTRIC ARCS. Johan Jetmund Thoresen, Christiania, and Filip Tharaldsen, Meraker, Norway. Filed Feb. 16, 1905. Consists in establishing an alternating-current electric arc, deviating the arc by means of a rotary magnetic field supplied with alternating current, and passing a current of gas past and in contact with the arc.

996,960. END-CELL SWITH. Johan M. Anderson, Boston, Mass., assignor to Albert & J. M. Andersen Manufacturing Co., Boston, Mass. Filed Dec. 20, 1910. Has a movable contact member, a reciprocating actuating device for the contact member, an electric motor connected with the actuating device to reciprocate the same, a selective device co-operating with the actuating device to determine in what direction the contact member shall be moved by the actuating device, and electromagnets to move the selective device in opposite directions independently of the actuating device.

996,963. ELECTRIC-LAMP CLUSTER. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Co., Chicago, Ill. Filed Aug. 6, 1908. A number of lamp sockets are movably attached to a hollow supporting body.

996,973. SWITCH. Charles E. Carpenter, New York, N. Y., assignor to Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Filed May 9, 1907. Has an auxiliary switch which opens after and closes before the main contact. A blowout magnet disrupts the arc formed when the auxiliary switch is opened.

996,975. RECTIFIER SYSTEM. Alexander Churchward, New York, N. Y., assignor to General Electric Co. Filed Oct 14, 1907. Provides means for maintaining stability of operation of rectifier and automatic means for operatively connecting the maintaining means when the average instantaneous current in the load circuit decreases abnormally and for disconnecting the same when normal conditions are restored.

996,979. VAPOR ELECTRIC APPARATUS. John T. H. Dempster, Schenectady, N. Y., assignor to General Electric Co. Filed Apr. 21, 1904. An arc-starting device, dipping into the mercury, has a contractile member serving when traversed by current to withdraw the device from contact with the mercury. Means are provided for cutting the arc-starting device out of circuit.

996,990. ELECTRIC-CIRCUIT CLOSER. Charles F. Lewis, New York, N. Y. Filed May 31, 1906. A casing incloses the contact members forming with them an integral removable device.

996,993. APPARATUS FOR AUTOMATICALLY OPERATING TYPEWRITERS. Thomas A. McCall, Columbus, Ohio, assignor to Automatic Typewriter Co., Cleveland O. Filed Mar. 19, 1908. Renewed Apr. 22, 1909. The typewriter is operated by a revolving cylinder driven by an electric motor.

997,003. ELECTRIC AND FLUID-PRESSURE CONTROLLER FOR INTERNAL-COMBUSTION ENGINES. Charles O. Pearson, New York, N. Y. Filed Aug. 17, 1908. A fluid-pressure supply and an electrical supply are both arranged to start the engine, one of these means being arranged to regulate the speed. Manual means control both sources of supply.

997,006. SHADE-HOLDER FOR ELECTRIC LAMPS. Adolph C. Recker, Oakville, Conn., assignor to Waterbury Manufacturing Co., Waterbury, Conn. Filed May 1, 1911. A locking ring encircles the top of the holder, keeping it in place on the lamp by the compression of a number of concentric springs.

997,012. APPARATUS FOR CHECKING THE USE OF TELEPHONES. Otto Schmid, Heilbronn, Germany. Filed Feb. 10. 1911. The telephone hook operates means which feed in a strip of paper each time the receiver is taken down.

997,036. BURGLAR ALARM. Columbus E. Blackburn, Hodge, La. Filed Dec. 15, 1910. A cylindrical block of insulating material is provided with a metallic end, which forms one terminal, and a spring actuated plunger, which forms the other terminal. While a door or window is in normal position the contacts

are held apart, but are allowed to go together when an opening is made.

997,042. CABLE TERMINAL. Frank B. Cook, Chicago, Ill. Filed July 3, 1909. Comprises a pair of halves removably secured together to form a head and each carrying front and rear rows of terminal members, each half having also an integral semi-circular base portion with a hole therethrough between the front and rear rows of terminal members for accommodating electrical conductors leading thereto.

997,043. CABLE TERMINAL. Frank B. Cook, Chicago, Ill. Filed July 15, 1909. A modification of the preceding.

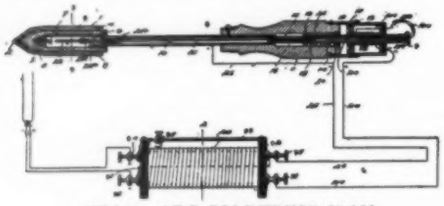
997,044. ARC SOLDERING-IRON. Michael Danko, South Bethlehem, Pa. Filed Oct. 22, 1910. A carbon arc in the interior of the copper head supplies the heat.

997,054. PENDENT ELECTRICAL SWITCH. William J. Gagnon, Bridgeport, Conn., assignor to Perkins Electric Switch Manufacturing Co., Bridgeport, Conn. Filed Sept. 4, 1908. An insulating body of an inverted cup shape with depressed shoulders on the top on opposite sides of the inner chamber, terminal plates on these shoulders and contacts extending therefrom through side openings into the chamber.

997,066. DEVICE FOR INSULATING THE TWISTED ENDS OF ELECTRIC WIRES. Johann Krannichfeldt, Cologne, Germany. Filed Nov. 22, 1910. A tube filled with a viscous insulating material has puncturable ends of a harder material protecting the viscous interior, but permitting the twisted ends of the wire to be inserted.

997,070. BACTERIOLOGICAL OVEN OR INCUBATOR. Henry Leland Lowe, Pittsburg, Pa., assignor to Scientific Materials Co. Pittsburg, Pa. Filed Aug. 22, 1908. A heating chamber surrounding a water compartment is heated by a resistance element. Current is switched on and off by a thermostat operating a make and break device.

997,087. INSULATED PIPE JOINT OR COUPLING. Sarah E. Peeples, Washington, D. C. Filed Oct. 18, 1910. Comprises coupling members, insulation therebetween, a tubular moisture and luting collecting and retaining member extending up-



997,044.—ARC SOLDERING IRON.

wardly into the upper coupling member and being flanged at its lower end, this flange being secured above the insulation and between the same and the upper coupling member.

997,106. ELECTRIC SWITCH. Jesse C. Walden, Mystic, Iowa. Filed Apr. 5, 1910. The switch point is operated in either direction by a pair of electromagnets.

997,135. TROLLEY. Walter W. Irwin, El Paso, Tex. Filed Nov. 23, 1910. Two trolley wheels set at an angle come into contact at their upper point, making a groove which at all times engages the trolley wire.

997,155. LAMP-REGULATOR. Edward H. Smith, Aberdeen, Wash. Filed Oct. 18, 1910. A lamp socket is provided with a piece of resistance wire and a movable part which may be turned to insert resistance into the lamp circuit.

997,165. TROLLEY. John Wdowicki, Jersey City, N. J. Filed Apr. 5, 1911. A modified form of harp construction.

997,194. ELECTRIC HEATER. Bertrand G. Jamieson and Carl A. Keller, Chicago, Ill. Filed May 4, 1909. Comprises a body portion of water-proofed cement, and a heat-producing element completely embedded in it, the element comprising a spirally-arranged coiled conductor having the convolutions of the coil and the windings of the spiral substantially spaced apart from each other to afford spaces for the cement whereby the conductor, throughout its extent, is inclosed.

997,215. SIGNALING SYSTEM FOR ELECTRIC RAILWAYS. Jacob B. Struble, Wilkinsburg, Pa., assignor to Union Switch & Signal Co., Swissvale, Pa. Filed Mar. 11, 1909. Has a transformer for each track circuit, a relay for each track circuit comprising a field coil and an armature coil, one of which is connected across the rails of its track circuit, an alternating-current generator for the transformers for the track circuits, a second alternating-current generator for the other coil of the respective relays, driving means for the generators, and an adjustable coupling between the two generators.

997,224. CIRCUIT CONTROLLER. Charles W. Yerger, Milwaukee, Wis., assignor to Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Filed Nov. 4, 1910. Comprises an automatic switch, a second automatic switch adapted upon opening to cause the first switch to open, and a master controller movable to one position to cause the second switch to close and movable to another position to cause the first switch to close. The second switch cannot close when the master controller is in the second position.

997,228. MOTOR-STOPPING DEVICE. William Bartholomew and David J. Phillips, Chicago, Ill., assignors to Troy Laundry Machinery Co., Chicago, Ill. Original application filed Aug. 9, 1909. Divided, and this application filed Sept. 27, 1909. A tension device normally holds out of engagement a switch blade, which is temporarily held in engagement with the contacts by a latch lever. A yieldable connection from the cover of an active machine element provides for stopping the motor.

997,230. AUTOMATIC-ALARM DRIP-PAN. John F. C. Bendt, Baltimore, Md. Filed Jan. 16, 1911. Contact is made, and an electric alarm actuated when a float in the drip pan rises beyond a predetermined level.

997,250. TIME SIGNAL FOR TELEPHONE-MESSAGES. Thomas W. Gardener, Nashville, Tenn., assignor of one-half to Charles L. Meyers, Nashville, Tenn. Filed Nov. 15, 1909. A rotating disk, with a fixed contact has an arm movably mounted above the disk, a contact carried by the arm above and normally out of engagement with the fixed contact, and means for locking said movable arm to the disk, said means being adapted to draw the movable contact down onto the fixed contact.

997,251. VERTICAL BEARING. Charles L. Goughnour, Canton, O., assignor to United Electric Co., Canton, O. Filed Nov. 18, 1909. Has an annular support-bearing on its body and a supply-cup thereon forming an oil chamber around its body with a rim higher than the supporting-bearing, a shaft being journaled in the bearing.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired July 10, 1911:

522,580. DYNAMO-ELECTRIC MACHINE. Louis Bell, Lynn, Mass.
522,581. CONTROLLER FOR ELECTRIC MOTORS. John B. Blood, Lynn, Mass.
522,597. ELECTRIC SWITCH. Joseph Hutchinson, New York, N. Y.
522,632. CIRCUIT-CLOSING DEVICE. Philip J. Walsh, Jr., Philadelphia, Pa.
522,655. CONDUIT RAILWAY-TROLLEY. John L. Creveling, Auburn, N. Y.
522,664. ELECTRIC DISTRIBUTION-BOX. Oscar D. Kleinsteuber and Monroe A. Kleinsteuber, Milwaukee, Wis.
522,670. DANGER-SIGNAL FOR RAILWAY-CROSSINGS. Myron W. Parrish, Detroit, Mich.
522,674. ELECTRIC METER. Gustave A. Scheefer, Peoria, Ill.
522,680. ELECTRIC-ARC LAMP. Moses S. Okun, New York, N. Y.
522,690. ELECTRIC-LAMP HOLDER. Martin P. Meyer, Rochester, N. Y.
522,694. ELECTRICALLY-CONTROLLED WHISTLE AND VALVE FOR OPERATING SAME. Charles E. Ongley, New York, N. Y.
522,707. TELEPHONY. Frank R. Colvin, New York, N. Y.
522,709. CONTACT-SHOE FOR ELECTRIC LOCOMOTIVES. John J. Green, Boonton, N. J.
522,710. CONTACT-BAR FOR ELECTRIC LOCOMOTIVES. John J. Green, Boonton, N. J.
522,711. SUPPLY SYSTEM FOR ELECTRIC RAILWAYS. John J. Green, Boonton, N. J.
522,718. ELECTRIC HEATER. Harry W. Leonard, New York, N. Y.
522,724. ELECTRIC SYNCHRONIZER FOR CLOCKS. Ludwig Von Orth, Berlin, Germany.
522,727. ELECTRIC LAMPLIGHTER. Joseph C. Chambers, Detroit, Mich.
522,733. ELECTRIC DOOR-OPENER. Henry F. Keil, New York, N. Y.
522,735. ELECTRIC-ARC LAMP. Peter Kirkegaard, Brooklyn, N. Y.
522,790. ELECTRIC-ARC LAMP. Edward F. Gwyer, Delaware, O.
522,834. ELECTRIC LOCOMOTIVE. Edward Hopkinson, Manchester, England.
522,835. ELECTRIC CRANE. Edward Hopkinson, Manchester, England.
522,837. CURRENT SEPARATOR. Louis F. Johnson, Poughkeepsie, N. Y.
522,841. ELECTRIC BELT. William E. J. Lawlor, Portland, Me.
522,865. CURRENT-INTERRUPTER FOR HIGH-POTENTIAL CIRCUITS. Elihu Thomson, Swampscott, Mass.
522,894. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Charles I. Greer, Washington, D. C.
522,896. HANGER FOR ELECTRIC LAMPS. Henry C. Henley, St. Louis, Mo.
522,919. ELECTRIC CIGAR-LIGHTER. Charles F. Reiff and Henry Munk, Fremont, O.
522,920. ELECTRIC GOVERNOR. Marcus P. Schenck, Springfield, Mass.
522,925. OPERATOR'S TELEPHONE-CIRCUIT. Thomas C. Walsh, Jr., Boston, Mass.
522,934. ELECTRIC CIGAR-LIGHTER. John J. Eberhard and Carl G. Schimkatt, Fremont, O.
522,948 and 522,950. ELECTRICAL MEASURING INSTRUMENT. Edward Weston, Newark, N. J.